

Technology Review

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MAY/JUNE 1992

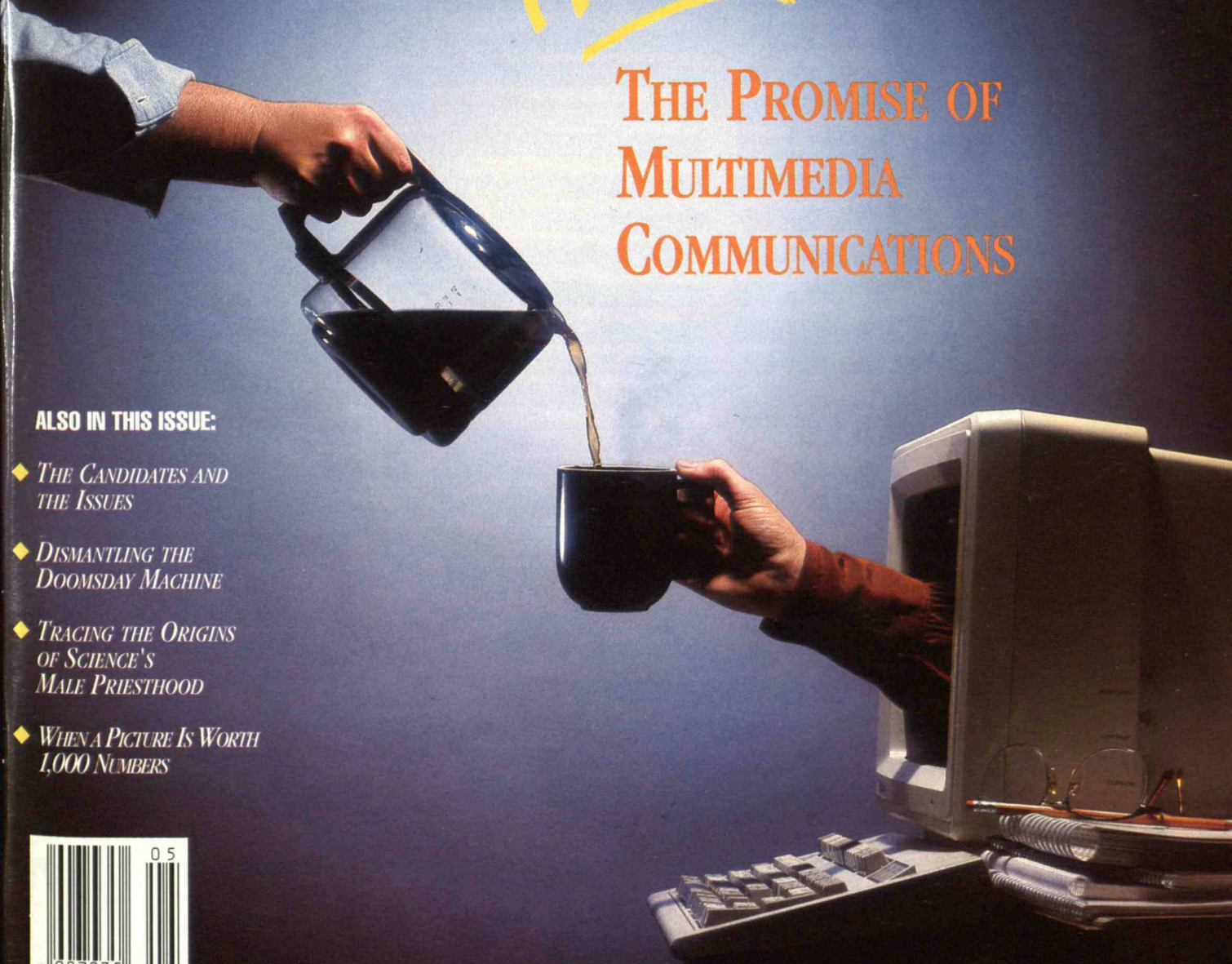
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*Being
There*

THE PROMISE OF
MULTIMEDIA
COMMUNICATIONS

ALSO IN THIS ISSUE:

- ◆ *THE CANDIDATES AND THE ISSUES*
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- ◆ *TRACING THE ORIGINS OF SCIENCE'S MALE PRIESTHOOD*
- ◆ *WHEN A PICTURE IS WORTH 1,000 NUMBERS*



technology review

Published by MIT

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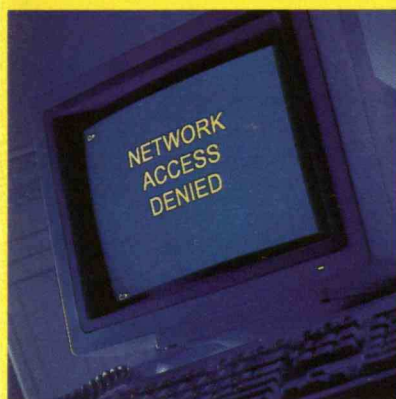
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[REDACTED] And what you do want them to know.

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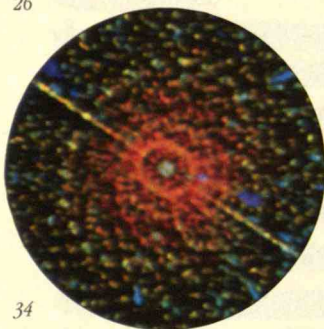


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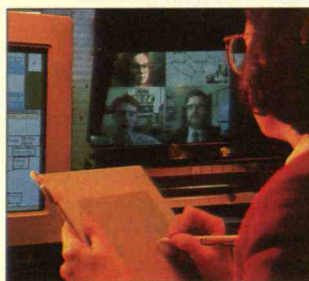
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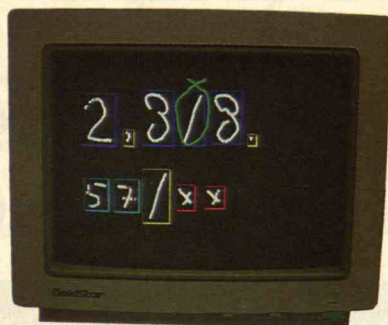
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Art direction and design: Nancy Cahners

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Technology Review (ISSN 0040-1692), Reg. U.S. Patent Office, is published eight times each year (January, February/March, April, May/June, July, August/September, October, and November/December) by the Association of Alumni and Alumnae of the Massachusetts Institute of Technology. Entire contents ©1992. The editors seek diverse views, and authors' opinions do not represent official MIT policy. We welcome letters to the editor. Please address them to Letters Editor.

Editorial, circulation, and advertising offices: *Technology Review*, Building W59, MIT, Cambridge, MA 02139, (617) 253-8250; FAX (617) 258-7264. Printed by Lane Press, Burlington, VT. Second-class postage paid at Boston, MA and additional mailing offices. Postmaster: send address changes to *Technology Review*, MIT, Building W59, Cambridge, MA 02139.

Subscriptions: \$24 per year, libraries and organizations \$27. Canada add \$6, other foreign countries add \$12. Contact *Technology Review*, P.O. Box 489, Mount Morris, IL 61054, (800) 877-5230 or (815) 734-6309; FAX (815) 734-4205.

Advertising representatives: Mark E. Lynch, Eastern Sales Manager, 9 Salem Drive, Saratoga Springs, NY, (518) 583-6086; The Leadership Network: SalesConcepts, Inc., 72 Spring Street, New York, NY 10012, (212) 941-8172; Detroit: Keith Olsen/Media, Birmingham, MI, (313) 642-2885.

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The Apple Macintosh Quadra.

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It would have immense storage and memory capacity. And it would have features like high-

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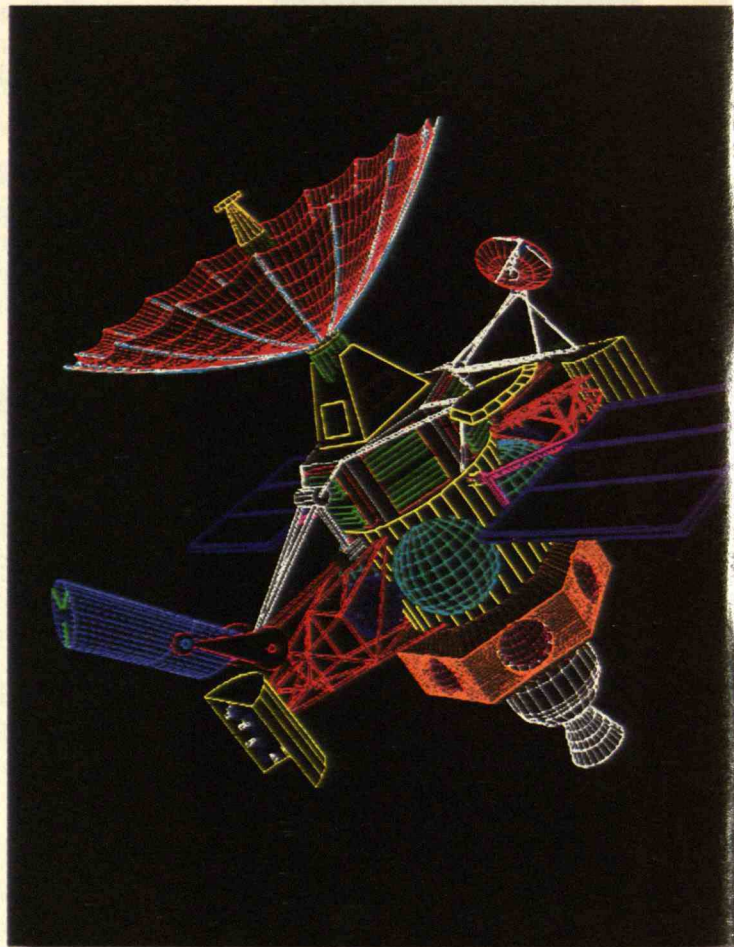
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By any measure, the Macintosh Quadra 700 and 900 are two of the most powerful personal computers ever designed. Both are based on the blistering Motorola 68040 microprocessor — a single superchip that integrates a 25 MHz processor, a math coprocessor and dual memory caches.

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Macintosh Quadra runs all the most powerful engineering software.



Built-in 24-bit video lets you create photo-realistic images without the expense of an extra card.

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*Comparisons are based on a 1991 independent research study conducted by Ingram Laboratories that tested a variety of personal computers running applications available for both the Macintosh and Microsoft Windows 3.0 environments. **24-bit video support for up to a 16" monitor — also available for 19" monitors. ©1992 Apple Computer, Inc. Apple, the Apple logo, AUX, Mac, Macintosh and "The power to be your best" are registered trademarks and Macintosh Quadra and SuperDrive are trademarks of Apple Computer, Inc. AutoCAD is a registered trademark of Autodesk, Inc. Backturner is a trademark of Microsoft Corp. Motorola is a registered trademark of Motorola Corp. NuBus is a trademark of Texas Instruments. SoftPC is a registered trademark of Insignia Solutions Inc. RenderPro is a trademark of Strata, Inc.

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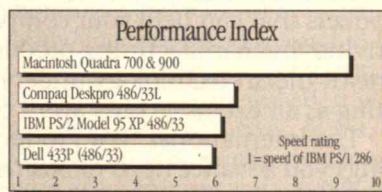
communications architecture lets you easily take advantage of features like distributed processing, allowing programs like RenderPro and BackBurner to utilize excess CPU cycles on other Mac computers or workstations for faster renderings.



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*Small third-party video card. †December 23/30, 1991, issue of PC Week. Mention of third-party products is for informational purposes only and constitutes neither an endorsement nor a recommendation. All product specifications and descriptions were supplied by the respective vendor or supplier. Orbiter images created. MacDraw® is a trademark of Schlamberg Technologies, Inc. MacTIPS is a registered trademark of AT&T Graphics Software Labs. Mathematica is a trademark of Wolfram Research, Inc. MicroStation is a registered trademark of Bentley Systems Inc. MS-DOS is a registered trademark and Windows is a trademark of Abstar Incorporated. VersaCAD is a registered trademark of Versacard Corp. X Window System is a trademark of MIT. UNIX is a registered trademark of AT&T. This ad was created using Macintosh computers.

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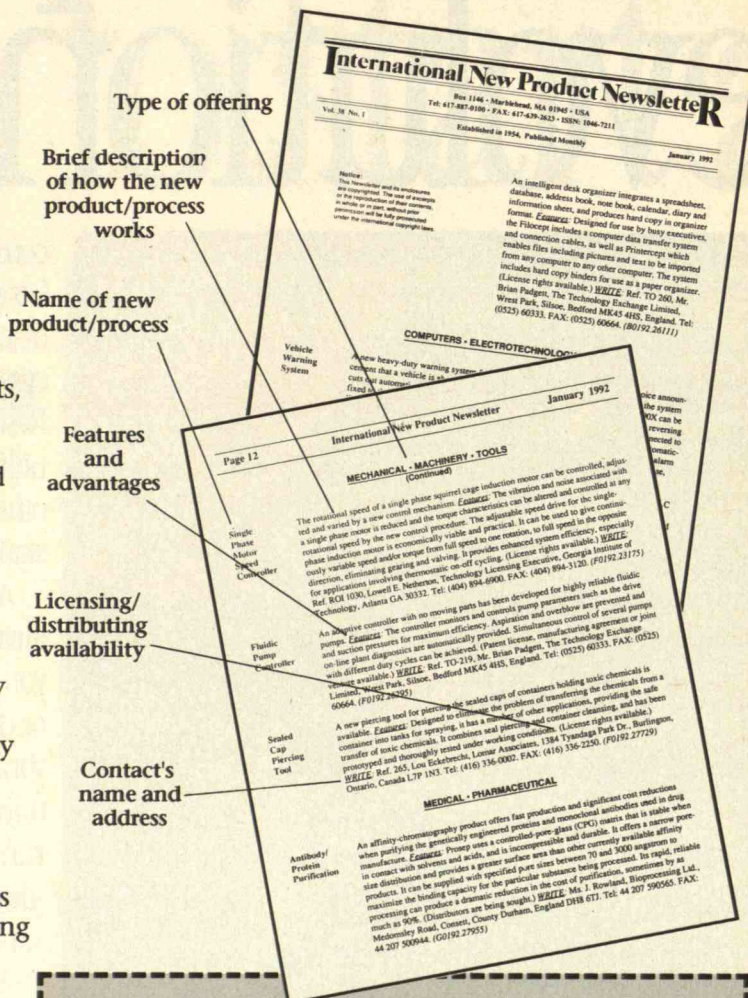
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First Line

Leading the Yankees

WE'VE studied the situation plenty by now, and it's clear that so many Japanese companies outperform their U.S. counterparts for one basic reason: they are making better products.

Unfortunately, the response of U.S. industrialists has not been to roll up their sleeves and show the world some Yankee ingenuity, but mostly to whine about the competition or indulge in bravado. "We rattled their cage," proclaimed Chrysler chairman Lee Iacocca last January after he and the heads of General Motors and Ford returned from their trip to Japan with President Bush. The only people rattled were Americans, at the prospect of their leaders making fools of themselves in a superficial display of solidarity. "One is less ashamed by the flu," said *Boston Globe* columnist Alan Lupo, referring to the President's fainting spell, "than by the more serious U.S. illness, which is our inability to look to ourselves for the sources and solutions to our problems."

Long accustomed to being number one in a world economic order now fading, our industry leaders have become soft and complacent, seemingly unable to respond to new forces. When questioned about erosion of market share, declining profits, or major financial losses, these leaders usually cite broad issues—unsatisfactory trade policies, the propensity of Americans to spend rather than save, the sorry state of U.S. public education—that are largely and conveniently someone else's business. Their own operations are assumed to be just as fine for today as they were in the past.

When the Conference Board and Industrial Research Institute polled nearly 100 R&D executives last year, these leaders waxed typically Pollyannaish. They "showed a surge of optimism for the future of America's technology-driven businesses," said the survey director, and a belief that the U.S. will be world leader in technology in the year 2000. Similarly, when members of

the Institute of Electrical and Electronics Engineers were polled by Gallup, a majority held that the United States would maintain its lead over Japan in nine out of twelve areas of technology into the next century.

Such whistling in the dark does not much impress our competitors, who are detached enough to critically assess the U.S. situation, skeptical of empty claims, and understandably tired of all the bashing. Lately, they've retaliated with a little of their own. "U.S. workers are too lazy.

*In industry as in
baseball, good players
can't win without
savvy managers.*

They want high pay without working," said the speaker of Japan's lower house of parliament in January, and they are of "inferior quality." Shortly thereafter, the prime minister himself joined the chorus, asserting that America's tradition of "producing things and creating value has loosened too much."

Many of our leaders were shocked—shocked!—by such statements and hastened to note that the productivity of U.S. laborers exceeds that of the Japanese. But the criticisms appeared to be directed less at the folks on the factory floor than at management. American blue-collar workers in Japanese-run factories—Honda in Ohio, Nissan in Tennessee, and Sony in California, for example—generally make products rivaling those manufactured at facilities in Japan. It is U.S. *executives* who appear to be lacking insight and direction, who are "too lazy," who are failing to use their country's indigenous resources—natural and human—to fuller advantage, yet who carp relentlessly about the competition.

The same tendencies can be seen in government. "Blaming foreign nations for our economic woes is standard fare for elected officials because it is invariably well received—particularly in areas of high unemployment," said Paul

Tsongas in his campaign manifesto. "It is a lot more rewarding politically to bash imports than to suggest that there may be fault in attitudes or strategies here at home. [But by] continuing to persist in denial we put off the necessary self-examination and rethinking that will lead to true competitiveness."

Such a result can only occur with targeted no-nonsense collaboration among leaders in government, industry, and academia—the forging of a uniquely American industrial policy. Its time has clearly come as the hands-off "free-enterprise" policies of Reagan and Bush produce only further slippage.

Where such collaborations now nominally exist, they offer sizzle but no steak. For example, the president's "National Technology Initiative," launched in February with much government fanfare on the campus (but without the sponsorship) of MIT, essentially offers industry a look-see at research already performed at the federal labs, and little else.

We could do a lot better. Sen. Joseph Lieberman (D-Conn.), writing in the *New York Times*, argues that "in alliance with business, the government should take as much as possible of the \$22.5 billion spent yearly at the federal laboratories and refocus it on commercial and industrial products and technological development." Lieberman's national industrial-renewal effort would encompass tax incentives, loans, and federal investment in industry, reorganization of government entities such as the Defense Advanced Research Projects Agency to directly serve economic growth, and a serious effort to "focus on the 22 technologies the White House has designated as critical to growth and then did nothing about."

An overhaul of the once invincible and still mighty U.S. industrial engine will entail facing some unpleasant truths and adopting some new approaches to manufacturing and marketing. This will not be as easy or as instantly satisfying as bashing the foreign threat du jour. But it is well within our means. ■

—STEVEN J. MARCUS

On January 14, 1992 we opened a billion dollar plant in the heart of Detroit. Some say that's stupid. We say it's responsible.

Our Jefferson North plant is a commitment to the quality of the product and the community.

We could have taken the easy way out, like a lot of companies are doing these days. We could have built our plant in a field outside a small town to keep operating costs down.

Instead, on January 14th we opened one of America's most advanced auto plants in the heart of Detroit. We're keeping thousands of jobs where they're needed most, in the inner city. And providing millions in taxes.

Jefferson is going to show the rest of the industry how to produce world-class quality, and improve the quality of community life. For us, it's a good feeling. For the consumer, it's a good product.

Environmentally, it's one of the cleanest plants in the world.

We think the new Jefferson plant will set new standards of environmental responsibility. We're using breakthrough technology to reduce the amount of waste materials in the earth and air.

Rather than having the overspray from painting cars end up in a landfill, at Jefferson the paint overspray will be collected, recycled and can be used as

underbody paint.

We'll save more than 50,000 tons of scrap every year by using returnable shipping containers with foam padding instead of wooden crates and cardboard.

We're using recyclable containers to transport liquids. Not the old 55-gallon steel drums.

Storage tanks for gas, oil and solvents are above ground to prevent contamination of water supplies. And the tanks are placed within concrete barriers.

Our own on-site water treatment facility cleans up 500,000 gallons of plant process water daily.

Chrysler technology isn't just for the cars we build. It's for where we build them.

Jefferson will be as efficient as any import operation in Tennessee or Timbuktu.

We're operating Jefferson on a lean production system. And that means lean in every step of the manufacturing process.

Our people function as a team, not as specialists working separately. Everybody together from the start, solving problems to avoid downtime later on. It makes sense and it saves dollars.

We have 206 robots at Jefferson, doing everything from welding body panels to applying the

finish paint coat. That sounds like a lot of automation. But compared to most plants, it isn't. We're using just enough of the best technology to build the best quality.

Parts delivery has been revolutionized. Instead of one central delivery point, trucks can pull up to 56 unloading docks placed around the plant. The assembly line is routed to pass by a truck bay when a part is required. Need an engine loaded into a vehicle? The engine will be there when the line rolls around.

American plants usually have several days of parts inventory stacked up. At Jefferson, we want to keep the parts inventory down to eight hours.

Minimizing waste and maximizing efficiency to improve quality. That's the whole idea behind Jefferson.

The most advanced technology, and the safest way to use it.

We believe we have not only the best production equipment at Jefferson, but also the safest working environment.

Management and union safety representatives were involved in the design and building of every work station in the plant. Safety features such as light screens and pressure-sensitive mats have been built into the manufacturing processes. Even the heights of the conveyors were carefully considered.

The goal at Jefferson was to set new standards of worker safety for the whole industry. We think we've done it.

The Jefferson difference: 2,100 experienced pros with almost a million hours of training.

The work force at Jefferson has more car building experience than any other in America, maybe the world. The average length of service for all employees is 26 years. These are the people who played a major part in turning this company around. They know what it takes to build quality.

But with all those years behind them, they still received over 900,000 hours of training. The new machinery in place at Jefferson isn't new to them.

You can buy technology. You can't buy experi-

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We built a whole new plant to keep a legend alive: Jeep® Grand Cherokee.

One brand sums up what four-wheel drive is all about: Jeep®. To the industry, it's a sport utility vehicle. To the world, it's a legend.

When you build a legend, you never change it unless you can improve it. The technology and experience at Jefferson will produce the highest quality Jeep® ever: Jeep® Grand Cherokee.

Grand Cherokee is the best-looking, roomiest, most comfortable Jeep® we've ever turned out. The engine is a 4-liter Power Tech Inline 6-cylinder, the most powerful and fuel efficient in its class. Ride and handling are better than ever. Anti-lock brakes are standard. Even an air bag is standard. And like every Jeep®, it goes anywhere.

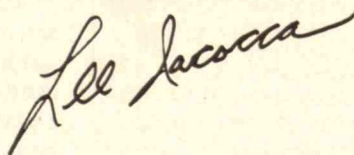
A lot of people love the Jeep® mystique, but still want the feel of the family car. For them, Jeep® Grand Cherokee is the answer. And we'll build plenty to go around—720 a day when Jefferson is at full capacity.

In a bad economy, Jefferson is good news. For the city, for Chrysler, for the country.

Pick up any newspaper any day and all you read are discouraging words. About the economy in general, and the car business in particular.

Perhaps the prophets of doom should take a hard look at what Chrysler is doing. We're opening a plant, not closing one. We're breathing life into an inner city, not letting one die. We're supporting American workers and what they can produce, not giving up the quality race to Japan or Germany.

In the car business you lead, follow, or get out of the way.



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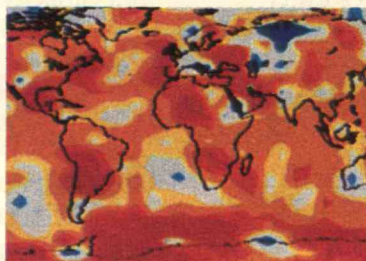
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Letters

A HEATED DISCUSSION

"Forecast Cloudy: The Limits of Global Warming Models" by Peter Stone (*TR February/March 1992*) ably notes the uncertainty in current efforts to model climate. However, in claiming that "most scientists believe" the range of results from current climate models bounds the uncertainty, Stone muddies the issue. I know of no poll of the world's scientists upon which Stone could have based his claim, and besides, the vast majority of scientists know little more than the average layperson when it comes to climate. Also, I'm not at all sure that this is an issue where what anyone "believes" is the appropriate basis for judgment.

In a similar vein, Stone's assertion that the skepticism of some scientists, including me, comes from "doubts over



whether the models are simulating small-scale processes accurately" misleadingly suggests that the doubts are vague. In fact, many of the problems with models are specifically identifiable. For example, when existing models predict warming in excess of about 3°F, it is in large part because of "water vapor feedback" that amplifies warming. As Stone points out, water vapor is the major greenhouse gas.

What's wrong here is that the increase in water vapor coming from the feedback response is determined significantly by numerical artifice: the relevant equations themselves are not known to be sound. Although observations show that upper-level water vapor is supplied mostly by ice carried aloft in deep clouds, the quantitative details of the process have still to be determined. The uncertainty is such that the feedback process could actually be negative,

bringing warming well below the range of current model results. Also, attempts have been made to use satellite data to infer the water vapor feedback, but these have erroneously assumed that geography or season are surrogates for climate.

If global warming does occur, we can be reasonably certain it won't be for the same reasons that operate in present models. Many of us in the scientific community have been disturbed by the massive international response to what are no more than guesses. Stone is right to conclude that it behooves us to do all we can to find out how our climate system really functions.

RICHARD S. LINDZEN

Alfred P. Sloan Professor of Meteorology
MIT

After finishing Peter Stone's article, some readers may wonder why there is such widespread (even if cautious) confidence that the earth's temperature is likely to rise from 3°F to 8°F by the end of the next century. The reason is that despite noisy and rancorous media debates over the science of global warming, several ironclad truths exist.

First, the heat-trapping effects of greenhouse gases are validated beyond doubt. Also, humans have already increased these gases by enough to have trapped an extra two to three watts of infrared radiative heating over each square meter of the earth, and the growing numbers of people who use technology to improve their standard of living are likely to exacerbate the problem. Moreover, we know there was one-third less carbon dioxide and one-half less methane in the air during the ice ages, which suggests that greenhouse gases work with other processes in large natural climatic cycles. And finally, climatic models used to predict global warming can, for all their shortcomings, reproduce many features of modern climates. They can capture the essence of the very large temperature differences between winter and summer, and they can simulate characteristics of large natural climatic changes in the geological past. They can even produce reasonable simu-

lations of such phenomena as the infrared heat trapped over oceans.

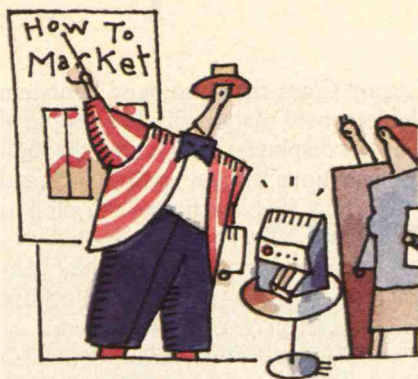
However, I agree with Stone that confidence in regional projections of climatic models is low. We need better answers. And I feel compelled to add that we need them fast. In a decade or two, global warming should be sufficient—another degree Fahrenheit or so—to constitute a clear signal that there really is a problem, yet if we wait until then to reduce greenhouse gases, the earth will be committed to at least several decades and perhaps several degrees of more warming.

In the meantime, we desperately need research to help us adjust as the changes, whatever they may be, occur. If we knew in advance what would happen, we could adapt agriculture, water supplies, fuel stocks, and even biological conservation strategies to preserve species and reduce damages. The faster ill effects unfold, the tougher it will be, which is why I believe we need to both study the pressure on natural systems and act to slow it down. We might thus buy time for scientists, society, and nature to deal more effectively with the situation.

STEPHEN H. SCHNEIDER
National Center for
Atmospheric Research
Boulder, Colo.

MARKET ORIENTATION

As someone who has managed three scratch start-ups in the biotechnology industry and invested in or consulted to a dozen or so more, I read the Edward E. Roberts interview with great interest ("How to Succeed in Business," *TR* February/March 1992). His concern with developing products that satisfy the needs of customers is especially noteworthy: entrepreneurs frequently ignore this market orientation, and, as a result, their businesses rapidly fail. The temptation is usually to worry about whether a potential product is technically feasible, but while that's the most obvious risk, experience has shown repeatedly that imaginative scientists can overcome seemingly intractable technical obstacles.



What really differentiates the stars from the dogs in my field of health care start-ups is simply superior products, and entrepreneurs need to be able to tell exactly which products those are. Football coaches should be able to recognize potential all-stars, stock brokers should be able to beat the stock market, and investors and businesspeople in biotech and health care should be able to picture change as well as muster the conviction to implement it. Anyone not comfortable and competent in seeing value where others see none ought to retain and rely on individuals with successful track records or else get a real job.

STEPHEN D. CHUBB
President
Matritech, Inc.
Cambridge, Mass.

Books written by professors and consultants on how to be a successful high-tech entrepreneur are to me, a survivor of Silicon Valley, like sex manuals written by priests. And now we have *Entrepreneurs in High Technology* by Ed Roberts—professor, consultant, and high priest of Route 128. As I began reading the interview with Roberts, I thought, What can a person who has been at MIT since 1953 know about high-tech start-ups?

But I was amazed: Roberts answered question after question as if he were reading my mind. To the extent that my experience is in any way generalizable, Roberts understands what is going on in the field. He understands the difference between working as a consultant—selling what you know, cheap, by the hour—and building wealth by risking the development of marketable products. He understands the tragic lack of

appreciation that engineers so often have for selling. And he understands that wanting to be your own boss is a bad reason to start your own company.

Now I must run out and buy his book.

ROBERT M. METCALFE
Visiting Fellow
University of Cambridge
England

Robert M. Metcalfe, founder of the Silicon Valley firm 3Com Corp., is writing a book on the story of the computer networking system Ethernet, which he invented.

POST-INDUSTRIAL SOCIETY DEFINED

In "Industrial Policy Redux" (*TR* October 1991), Bennett Harrison writes that the "intellectually clever notion of a 'post-industrial society' was always misleading," and that "the United States is becoming an increasingly complex industrial society." I don't know who Mr. Harrison had in mind, but if you light a match to a straw man, it will burn brightly. In my own use of the term "post-industrial," going back to *The Coming of Post-Industrial Society*, which I published in 1973, I noted that at least three changes would occur.

First, I said the number of people employed in the manufacturing sector would shrink, especially the industrial working class. This has occurred. Second, a new form of manufacturing, information-based, would supplant heavy industry. Third, and most important, innovation would proceed from the codification of theoretical knowledge, rather than from the old mechanical tinkering. This is exactly what we have seen in such areas as solid-state physics, biogenetics, and communication theory.

It so happens that I agree with Mr. Harrison's call for new thinking about industrial policy, but he should avoid facile polemics, as well as intellectually misleading statements.

DANIEL BELL
American Academy of Arts and Sciences
Cambridge, Mass.

CONSPICUOUS WORK

In "Workers of the World, Unwind" (*TR November/December 1991*), Juliet B. Schor focuses on the economic reasons for the long hours management people work. However, I believe there are also social and psychological reasons.

With the Fair Labor Standards Act of 1938, which required overtime pay for non-executive employees working more than 40 hours per week, companies found that it was most cost-effective to hire a lot of clerical staff members and get them out of the office by 5:00. In fact, it became one of the distinguishing features of executives that they did not leave the office until well after the exodus of stenographers and clerks.

In his 1899 book *The Theory of the*

Leisure Class, the sociologist Thorstein Veblen noted that upper-class people of that era displayed their status through "conspicuous leisure," which included such highly visible activities as riding to the hounds. Present-day executives demonstrate their status through "conspicuous work"—that is, by working when the lower class has gone home.

PETER M. RINALDO
Scarborough, N.Y.

UNIDENTIFIED FILING OBJECTS

Object-oriented programming, which uses self-contained "building block" units of software, is certainly an important and promising technique in computer science. However, in "Software's New Object Lesson" (*TR February/March 1992*), Robert Haavind wildly exaggerates its transformative powers. Computer scientists use the term object-oriented programming to refer to methodologies that have been around for 10 years or more, and although these methodologies are indeed helpful, they do not fundamentally change anything.

Also, Haavind complains that hand-crafting software is overly expensive. Yet computer programming is inherently a design process. Good software requires careful design, which is expensive in every industry. Considering the complexity of the product, software design is relatively cheap.

The way the author holds up the electronics business as something for the software industry to emulate seems strange as well. Could he be talking about the same electronics business that continues to deliver us a welter of similar yet incompatible products?

Finally, why do all the quotes in the article come from companies selling object-oriented products? Haavind seems not to have interviewed a single academic source. I am disappointed to find this kind of misleading hype in *Technology Review*.

ANDREW MYERS
MIT Laboratory for Computer Science

Robert Haavind says that people could assemble computer programs from

components in much the same way that they assemble a stereo system. This is way off the mark. A more apt analogy would be writing: imagine composing even a short article by drawing on a library of stock paragraphs. The search time for finding a suitable paragraph would likely be prohibitive.

The single credible claim in the article is that an object-oriented software system costs four or five times as much to design as a conventional one. Designers must push, squeeze, and twist their applications into the object-oriented package, so naturally the result is a higher price tag.

ROBERT RINDER
Danbury, Conn.

VACCINES THROUGH THE AGES

As Anna Aldovini and Richard A. Young write in "The New Vaccines" (*TR January 1992*), vaccines have made notable contributions to humankind. However, the decline in tuberculosis, bubonic plague, and influenza the article cites are not among them. In advanced nations, most of that progress occurred before vaccines were even developed.

Aldovini and Young also fail to mention the checkered history of many vaccines, which includes poorly designed clinical trials, high incidences of serious side effects, and ineffectiveness demonstrated only after millions of doses. The depressing record of today's marginally effective flu vaccine is far from atypical. We need to improve methods of testing and evaluation as much as techniques for developing vaccines themselves.

WILLIAM G. ROTHSTEIN
Baltimore, Md.

BUREAU OF MISSING PERSON

"Computerized Searches for Cancer Cells" by Lisa Watts (*MIT Reporter, TR January 1992*) neglected to include our colleague Paul N. DiCaprio as a member of the Lincoln Laboratory team that carried out the work.

R.L. HARVEY
K.G. HEINEMANN
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MIT Lincoln Laboratory

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FRIENDLY CHATS WITH COMPUTERS

 A caterer delivered some sodas to MIT researchers, then asked for directions to his next stop. The scientists pointed to the computer they were developing, a machine named Voyager designed to converse with people in everyday English, and the man questioned the machine. It responded and he walked out. After expressing their amazement at his nonchalance, the researchers realized this was just what they'd hoped for—a system so easy to use that people wouldn't realize how difficult it is for computers to comprehend speech and respond.

Researchers at MIT have been working on Voyager since 1989. Although its vocabulary is only 350 words and its range is limited (the system gives directions to sites in a small area of Cambridge), anyone can ask the location of, say, a Chinese restaurant. If the machine doesn't know the answer immediately, it will request more information until it can give detailed instructions by voice.

By contrast, the speech-recognition systems now on the market are essentially dictation machines, in which people speak rather than type in information. But even the best of these systems can respond to only simple commands. The devices also require pauses between words, cannot handle informal speech, and often must be trained to recognize each user.

Victor Zue, who directs the research group in MIT's Laboratory for Computer Science that has developed Voyager, says his aim is to create "spoken-language systems" that allow people to speak to computers as they would to other people. Speech, he says, is the most natural and efficient form of communication and "a graceful way that people can interact with machines."

Spoken-language systems should enable users to avoid special training and the tedious task of typing requests into a machine. But developing these programs requires drafting rules that



make sense of complicated, irregular grammar. To accomplish this, Zue's software uses the context of one or more comments. For example, the difference between "there" and "their" can be clear based on whether a person has asked directions or is talking about something belonging to a group of people. And by assigning probabilities to combinations of words, the computer "doesn't have to recognize every word before it knows what someone is saying," Zue says.

Responding Correctly

The approach is similar to that being taken by a number of research groups, says Richard Stern, an associate professor of electrical engineering at Carnegie Mellon University who is also conducting spoken-language system research. But, Stern says, Zue's group is at the forefront of integrating speech recognition and language understanding.

In a test of 5,000 requests put to Voyager by a wide range of people, the computer misinterpreted individual statements 12 percent of the time, Zue says. Because it's interactive, however, the system ultimately gave correct informa-

Need directions? Put on the microphone headset and ask for information from the Voyager computer at MIT's Laboratory for Computer Science. The machine will provide oral directions and a map.

tion for virtually all the requests, except for those that did not make sense to the machine, such as, "Where is my dog?"

By the end of the year, Boeing Aircraft Co. hopes to use technology developed by Zue's group as an aid for airplane mechanics who are assembling and maintaining flight equipment. Because mechanics frequently have to crawl around in tight spaces and use both hands at once, they have to extricate themselves when they need information. A spoken-language computer system, to which mechanics are linked by microphones, should allow them to get directions, says Caroline Fu, a Boeing computer service manager. "The beauty of the MIT system is that it's spontaneous," she says. Mechanics have their minds on their tasks and aren't thinking of which word to say first.

Zue's team is also one of a number of groups developing airline-reservation systems that respond to oral requests about destinations, flight



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times, prices, and seating. The team is also creating systems that could provide telephone directory assistance and literacy tutoring. Finally, the group is tackling basic research problems in speech recognition and language processing, including detection of unknown words, separation of background sound, and improvement of computer response time.

—GWENDOLYN FREYD

LEARNING FROM SUCCESS

 Lessons about Third World development have often been drawn from failure. *We Don't Know How*, a 1973 critique of programs sponsored by the U.S. Agency for International Development, could be the title for most such reviews. But economist Judith Tendler, a professor in MIT's Department of Urban Studies and Planning, has been taking the opposite tack: in her two recent evaluations of projects financed by the World Bank and Ford Foundation, she focused on the programs' successful ingredients.

Although outside planners and economists commonly think of politics as a hindrance to project implementation, and have often tried to bypass existing political groups, Tendler has found that elected officials frequently play a valuable role. For example, the governor of a Brazilian state where the World Bank was helping to finance a rural water supply project offered all needed assistance—as long as the state agency doing the work promised to complete it a year

before the next election.

To take advantage of politics, Tendler suggests completing development projects within single election cycles. And outsiders such as the World Bank might find it wise to change their method of designing programs with a large number of standard elements. Typical rural development projects, for instance, consist of agricultural, water supply, credit, and other components. Instead, the groups could let local leaders select from a menu of development activities, Tendler says.

Failed development programs are often attributed to political corruption, but that has also been found in successful projects, according to Tendler. Furthermore, she says, staff members who monitor for graft in projects are vulnerable to being bribed

Gabrielle Watson, a graduate student in city planning at MIT, saw the value of community involvement in development projects when a neighborhood group negotiated an agreement between Brazilian property owners. One party agreed to stop dumping his sewage into the open storm drain to the left of the stairs; the other allowed his land to be dug for a sewer line.



PHOTO: SÃO PAULO MUNICIPAL GOVERNMENT

as well. A more realistic approach may be to design projects so they are less susceptible to corruption. For example, project sponsors can instruct villagers who benefit from the work in how to evaluate project quality. Consider what happened after village residents in Bangladesh were told how a culvert by the side of a road should be built. They shouted at and threatened a worker because he wasn't wetting the bricks as they had been told he should. The residents knew that an improperly made culvert could collapse during the rainy season and cause the road and surrounding farmers' fields to dam up.

Other MIT researchers agree that community members and municipal agencies are essential in development work. Gabrielle Watson, a graduate student in city planning, has found that neighborhood associations made the difference in pressuring state engineers to set up water and sewage services for three squatter settlements in São Paulo, Brazil. The engineers also relied on these groups to enlist residents in digging trenches in places inaccessible to earth-moving equipment.

Biswapriya Sanyal, an associate professor in the Department of Urban Studies and Planning who has helped create low-priced housing and income-generating projects in Zambia, points out that politicians there often resented the typically higher paid employees of non-governmental organizations who implemented development

work. For a project to have a wider impact, he says, the sponsoring group must interest the government in replicating the work—which is hard to do if the government has been removed from the original process.

Cutting Teeth on Easy Tasks

Assigning tasks to the appropriate entities is another important way to achieve development goals, according to Tendler. Inexperienced government agencies should be allowed to "cut their teeth" on easy tasks.

For example, Tendler points to the management of the Brazilian hydroelectric power system. In the late 1950s, the Brazilian government decided to expand the system, which had until then been run by a foreign utility. This change worked smoothly because the government at first took on just one task—the easier job of generating power—while the foreign utility continued to handle the more complicated distribution effort. Later the government assumed that job as well.

By contrast, when Argentina was in the same situation, the fact that its plants were oil-fired and therefore had been located near distribution sites made it impractical to separate generation and distribution. The state therefore produced and distributed electric power from the beginning, which proved less successful than the Brazilian model.

The key, Tendler says, is to "pay attention to what works well."

—SUSANNE FAIRCLOUGH

CHECKING CHECKS



Americans write 50 billion bank checks a year. For every one, a bank employee enters the amount of the check into a computer and a second employee checks the first person's work. The effort is a waste of time and money, according to Amar Gupta, a senior research scientist at MIT's Sloan School

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of Management, who has been developing software to read the sums written on checks below the datelines.

Gupta and his research team have come up with a program that first scans the check and then focuses on the handwritten numbers. At this point, the software tries to contend with writing inconsistencies such as slants and figures that run together. The system separates digits into roughly uniform shapes, turns numbers to upright positions, and corrects for thickness variations by skeletonizing lines. Then the system uses a neural network trained to actually identify the numbers. The software can recognize a digit even if it has a detached section or has been written with a pen that skipped.

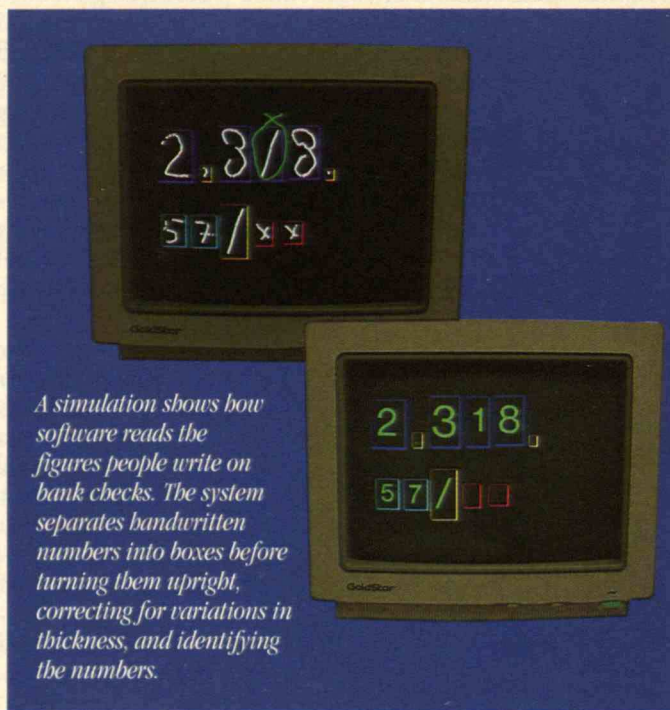
The greatest difficulty has come in ensuring that the system can handle fractions of a dollar, since these amounts can be written in many different ways—with, say, zeros or x's. (Competition among banks for customers who want to write checks their own way precludes the idea of providing individual places for each numeral.) The neural network is set up to identify fractions by making educated guesses rather than by recognizing a set number of styles, which could stymie the system too often, explains Nasser Ahmad, a graduate student who is working on the project.

Tests conducted with hundreds of checks deliberately written to confound the software show that it correctly recognizes complete strings of numbers more than 85 percent of the time. This level of accuracy is high

enough that a British bank plans to test the system this summer.

Meanwhile, the Gupta team is continuing to work on improving accuracy, although the researchers are not concerned with achieving a perfect system since they figure that each bank would still employ one person to verify check amounts.

Systems such as Gupta's could be the "linchpin" in reducing personnel costs associated with check cashing, says Alan Ostroff, a vice-president at Michigan National Bank and a banking automation expert. Moreover, according to Gupta, scanning could help streamline the general system of



A simulation shows how software reads the figures people write on bank checks. The system separates handwritten numbers into boxes before turning them upright, correcting for variations in thickness, and identifying the numbers.

check deposits. Today the institution in which a check is deposited has to send it to the bank from which the funds are being drawn, sometimes with intermediate stops at other banks. Sending only electronic images of scanned checks would save millions of dollars in annual postage costs, he says, possibly reducing customers' check-writing fees.

—SHERRIE SAINT JOHN

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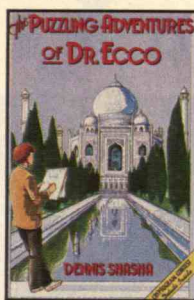
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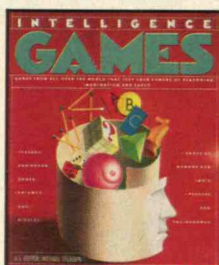
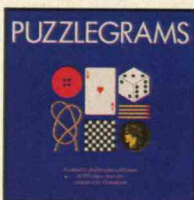


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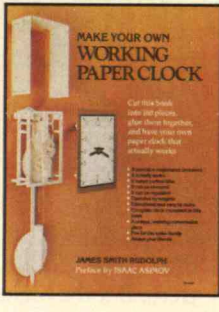
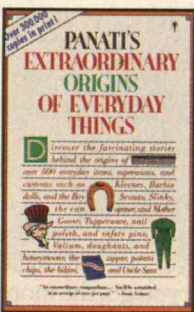
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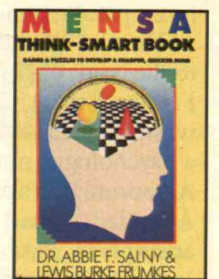


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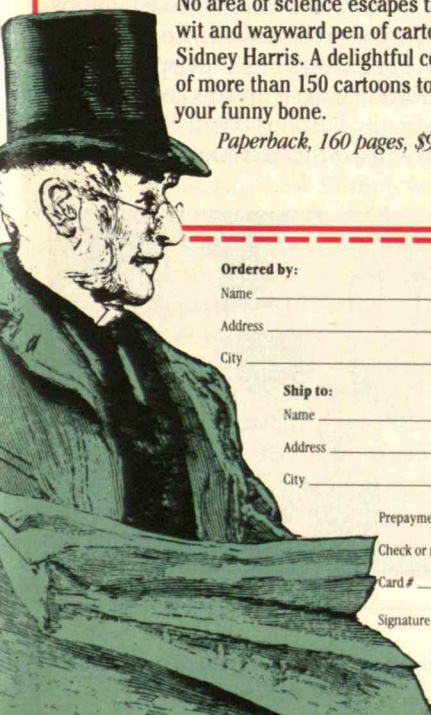


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Trends



The Study of Studies

Medical researchers call it the “oat-bran syndrome.” First, a scientific journal reports an extremely promising result—say, oat bran’s reputed ability to lower cholesterol—and several months later another study appears claiming that the first one is all wet.

What’s a muffin-lover to think? Did the second study cancel out the first? If a third study is favorable, has the oat-bran hypothesis triumphed by a score of two to one? And if not, at what point has a beneficial effect truly been demonstrated?

The cure for oat-bran syndrome, according to some researchers, bears the high-sounding name of “meta-analysis,” which loosely translates as the rigorous and scientific study of studies. “Meta-analysis is like being in a helicopter and rising from a forest,” says Ingram Olkin, a Stanford University statistician and co-author of one of the first textbooks in the field. “When you

are on the ground, all you see are single trees. But the higher up you go, the more forest patterns you can detect.”

The idea for meta-analysis dates back to the work of English geneticist Ronald Fisher in the 1920s, though the term wasn’t coined until 1976 by Gene Glass, a psychologist now at the University of Arizona. Its rapid growth in North America began in the 1970s with attempts by psychologists and social scientists to review the myriad studies that tried to measure the effects of the socially oriented legislation.

For example, a 1982 meta-analysis for the U.S. Department of Education looked at 157 studies measuring the effects of school desegregation on black students and discovered only a small increase in standardized reading scores

Meta-analysts Thomas Chalmers and Joseph Lau are promoting a new computer database that would indicate the impact of any new study in a controversial area.

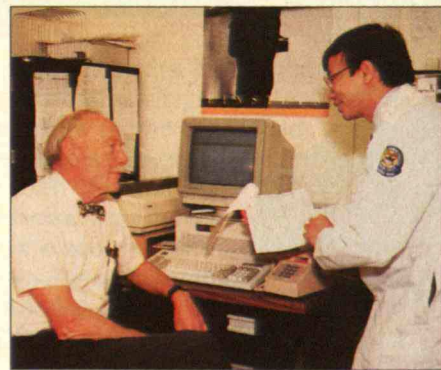
Meta-analysis, the systematic study of studies, may help cure the “oat-bran syndrome,” an all-too-common situation in which scientific results released one month may be completely reversed the next.

and no change in mathematics scores. More damning was the revelation of glaring methodological weaknesses, as only 19 of the studies involved statistically valid comparisons.

In the last decade and particularly in the last five years, the number of meta-analyses has soared, primarily because epidemiologists have begun to apply the technique to a variety of medical phenomena. For example, studies of the link between lead exposure and IQ scores, the safety of a natural childbirth after a caesarean section, the effectiveness of antibiotics in colon surgery, and the connection between birth control pills and blood clots have all been subjected to meta-analysis.

To conduct a meta-analysis, researchers must gather all relevant data, including the so-called “fugitive literature”—unpublished studies thought to show no clear trend, which may amount to as much as 10 percent of the experimental evidence. They can then apply a variety of techniques, which tend to follow two general approaches.

One, the “fixed-effect” model, lumps small, splintered studies into one huge study. For example, in 1988 epidemiologist Gordon Guyatt and his colleagues at McMaster University in Hamilton, Ontario used this technique to analyze



ten studies to try to determine whether exercise after a heart attack lowers subsequent death rates. Though only one study had shown a statistically significant decline, the fixed-effect analysis revealed that exercise decreases death rates by 25 percent. "All the individual studies were too small to see the effect," said Guyatt.

The other approach, the "random-effects" model, tries to factor out abnormally large effects produced by one or two papers, significant sex or age differences, or other variations. One powerful random-effects technique works by shuffling and reshuffling the statistical deck to determine whether leaving out various studies will produce the same overall results. If an effect appears with all possible shufflings, then the laws of probability shout that something real has been unearthed.

Thomas Chalmers of Boston's Veterans' Administration Medical Center and Joseph Lau of Tufts University have used both techniques to evaluate a variety of once-controversial medical treatments, and they've found that the fixed-effect model arrives at an earlier verdict and is highly reliable. "Among dozens of analyses, there hasn't been one instance in which a fixed-effect model gave a result that was not ultimately proven true," says Lau.

So convinced that meta-analysis can unearth conclusions before they are otherwise noticed, the two researchers are pushing for a new approach to scientific publishing that would set up a computer database for studies in contentious areas. Any new finding would be added to the list and quickly meta-analyzed to show its overall impact on the issue at hand.

Despite the enthusiasm, not all researchers are convinced; some critics label the new approach "mega-silliness." John Bailar III, a McGill University biostatistician, says, "One difficulty is the old problem of garbage in, garbage out. You can't make good work out of every bit of research," and numbers can mask the shortcomings.

—STEPHEN STRAUSS



"Save Jobs, Not Owls" has been a call to arms against the Endangered Species Act in the Pacific Northwest. Unless conservationists can stem a rising tide of opposition, the act itself—scheduled for reauthorization this fall—may be endangered.

The Endangered Species Act and Its Discontents

The Endangered Species Act is scheduled to go before Congress for reauthorization this fall, and unless conservationists can muster enough support for it, the act itself may be endangered. Signed into law by Richard Nixon in 1973, the act must be re-evaluated every five years. And though it has survived congressional debate thus far, some fear the outcome may well be different this time around.

The act is widely credited for bringing back many species—such as the whooping crane, the sea otter, and the brown pelican—from the brink of extinction. But as economic interests square off more frequently against conservation goals, the act has become increasingly

ridiculed and vilified. For instance, in communities throughout the Pacific Northwest, home to the northern spotted owl, "Save Jobs, Not Owls" is a bumper-sticker rallying cry.

Department of Interior Secretary Manuel Lujan, Jr., after repeatedly stating that the act is "too tough" and must be changed, recently proposed special legislation: instead of forcing the region to make the painful economic sacrifices to increase the bird's numbers as required by the law, it would be permissible to maintain the northern spotted owl at current population levels.

Senator Robert Packwood (R-Ore.) has also joined the chorus, proposing amendments that would consider economic and political factors earlier in the process. And what is perhaps the most extreme action, Representative James Hansen (R-Utah) has submitted a Human Protection Act that would prohibit even *listing* a species as endangered

if the potential economic costs to society outweigh the potential benefits.

Conservationists believe such tampering would effectively eviscerate the act. For example, Randall Snodgrass, director of wildlife policy at the National Audubon Society, fears that "if economists have to do a cost-benefit analysis before listing a species, that will mean very, very few, if any, plants and animals will ever get listed again."

Under the law, determination of whether a species should be listed as threatened or endangered, or whether development will jeopardize that species, must be made solely on the basis of biology. If the Fish and Wildlife Service concludes that a project will jeopardize the species, that agency must then identify "reasonable and prudent alternatives" in order that harm to the species be avoided. But if no reasonable alternative can be found, the project is halted.

The God Squad

Backers of biologically unacceptable projects do have some recourse, however. In 1978, when the snail darter held up completion of the Tellico Dam project in Tennessee, Congress amended the act by creating the Endangered Species Committee, dubbed the "God Squad," a cabinet-level group that can give the go-ahead to a stalled project if the benefits of the project are determined to outweigh harm to the species. But the God Squad does not necessarily favor economics over environmental concerns on the rare occasions that it is invoked. In fact, it ruled in favor of the snail darter. And of the three times it has convened, only once, for the Gray Rocks Dam project in Wyoming, did it grant a limited exemption to developers accused of endangering the native whooping-crane population.

The hallmark of the act is that it considers all endangered species to be of equal "incalculable value." Consequently, a tiny button cactus merits the same protection accorded a glamorous wildlife-poster species like the bald

eagle. It is this egalitarianism—which conservationists consider to be the cardinal virtue of the act—that becomes the lightning rod for controversy, especially when the species that threatens to scuttle a \$100 million dam project is a nondescript little minnow. "If the debate is framed in such a way that building a dam will 'cost' us the snail darter," says John Baden, director of the Foundation for Research on Economics and the Environment in Seattle, "many people feel that's no big deal."

Conservationists concerned that such attitudes are intensifying have organized not only to defend the act but also to strengthen it. The Endangered Species Coalition, representing nearly 30 national and international organizations, is lobbying Congress to streamline the listing process, which at current rates will require 50 years to clear the backlog of candidates for listing. It would also make an intentional violation of the act a felony punishable by up to five years in jail. And it would allow the government to sue offenders for damages.

In addition, an amendment to the act introduced by Representative Gerry Studds (D-Mass.) would double annual spending on endangered species programs and require that recovery plans be formulated for all listed species by the end of 1993. (Presently, such plans have been implemented for only half of the species listed.)

But such efforts may be misguided, laments Baden. "Environmental groups should identify programs that both endanger species and are subsidized by taxpayers' dollars," he says. "You can build a very strong argument, especially in bad economic times, to eliminate those programs. What supporters of the act should aim for is a coalition of the Audubon Society and Sierra Club with the National Taxpayers Union." The objective, says Baden, should be "to harness what's ethically right with what's ecologically sustainable and economically efficient."

—DAVID BJERKLIE (*The author is a science reporter for Time.*)

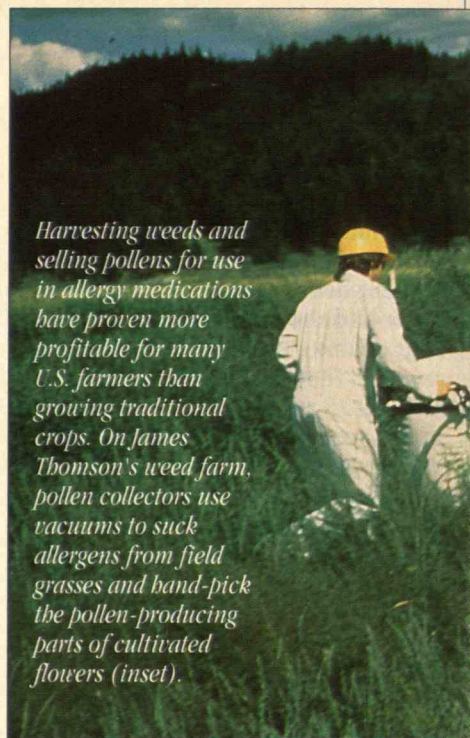
Harvesting weeds and selling pollens for use in allergy medications have proven more profitable for many U.S. farmers than growing traditional crops. On James Thomson's weed farm, pollen collectors use vacuums to suck allergens from field grasses and hand-pick the pollen-producing parts of cultivated flowers (inset).

Hay Fever Harvest

James Thompson's farm in Monmouth, Ore. gives new meaning to Ralph Waldo Emerson's maxim that a weed is simply a plant growing in the wrong place. On Thompson's 130-acre plot in the verdant Willamette valley, a hundred miles from the Northwest coast, weeds are more than just one of many factors affecting the success of the harvest—weeds *are* the harvest. Thompson carefully tends some 200 species from crabgrass to sagebrush and collects their pollens for a leading pharmaceutical manufacturer to use in allergy medications and research.

Replete with 10 greenhouses and a large processing facility, Thompson's pollen farm stands without peer as one of the only facilities in the world devoted exclusively to the cultivation of allergenic extracts. But a growing network of farmers of both large and small operations have also recently discovered that harvesting pollen from the weeds on their land can augment their income from more traditional crops.

Recognizing the difficulty that large pharmaceutical firms might have in collecting high-quality pollen samples from the patchwork of sellers around the world, Thompson convinced Miles Pharmaceuticals—the largest manufacturer of the so-called "immunotherapeutic"





little old ladies who have collected a certain variety for us for years," he says.

In 1986, Missouri farmer George Sneed began in earnest to harvest pollens from the weeds on his property, eventually generating nearly as much income from weeds as from his staples of soybeans and corn. Like Sneed, a cluster of North Carolina farmers of corn and other crops have made a specialty of harvesting pollen from the acres of ragweed that infest their lands to sell to nearby Greer Laboratories, another producer of allergenic extracts.

All told, some 50 operations in the United States will harvest more than a million grams of pollen from grasses, trees, ornamental plants, and other varieties known to cause allergic reactions in humans. The harvest is sizable, considering that a single gram of some pollen varieties comprises more than a million grains.

The efforts of Thompson, Sneed, and others are ultimately driven by the largely unexplained fact that the tiny pollen grains, borne by insects or by the wind to propagate most plant species, cause millions of people to wheeze and sneeze. In the United States, for example, roughly a tenth of the population is believed to suffer from some type of allergy. Over-the-counter allergy medications such as antihistamines and decongestants grossed some \$500 million last year in the United States alone—one of the largest sectors of the multibillion-dollar pharmaceutical industry.

The lion's share of the pollen harvest will be used to manufacture purified extracts for use as allergy skin tests to determine individuals' susceptibility to specific allergens and as ingredients in the most widely accepted medical treatment for allergies: a long series of inoculations designed to desensitize an individual to a specific allergen by gradually elevating its presence in the bloodstream.

A small but important fraction of the pollen will be used for what Dr. Gerald Gleich, a researcher at the Mayo Medical Clinic in Minnesota, calls a "renaissance in the field of allergy research." Purified pollen is used as a trigger to help

researchers study why an offending allergen such as ragweed pollen causes some people's immune systems to leak out chemicals such as histamines that constrict the body's airways, dilate blood vessels, and force the production of mucus.

Blocking Allergic Responses

Some researchers have investigated variations in pollen species for clues that could help counter allergic responses. Scientists at Johns Hopkins University, for example, have chemically altered ragweed pollen in order to develop a substance they call an "allergoid." This may be more easily tolerated by an allergy sufferer, thereby allowing more rapid and effective desensitization treatments than standard allergy shots, which consist of purified extracts of actual pollens.

Perhaps the most recent and exciting research, though, seeks to block allergic reactions before they happen. For instance, Tse Wen Chang, co-founder of the Houston-based biotech firm, Tanox, has developed a so-called monoclonal antibody to home in on and deactivate production of the antibodies that recognize allergens and signal the immune response to begin. Although Chang doesn't expect to start human trials with the drug until next year, many in the field view the project with optimism because of Chang's track record: he contributed to the development of the first monoclonal antibody approved by the U.S. Food and Drug Administration. Called OKT3, the drug is used to prevent the rejection of kidney transplants.

Meanwhile, James Thompson's business is growing as fast as the weeds on his farm. A decade ago, his operation began with just a greenhouse and a tractor shed, but next year he will collect almost 100,000 grams of pollen from the farm's grasses alone—an area of particular interest to Thompson, who suffers from hay fever. "As long as people have allergies," he says, "there will be a need for good-quality raw materials."

—SETH SHULMAN

pollen extracts used in allergy shots—to underwrite his operation. In turn, he guarantees the company a supply of high-quality pollen from the gamut of domestic plants that produce allergens.

Today, more than a decade since he started the venture, the farm puts Thompson's training as a medical botanist to the test, as he must continually rotate his vast assortment of species. He and his crew have also had to develop a battery of innovative cultivation techniques, including special vacuums that suck the pollen from plants in the field.

Unlike Thompson's singular effort, most of his counterparts produce pollen in addition to other crops. As Miles' manager Anthony Bonanzino explains, the company complements Thompson's harvest with pollen from numerous sources in the United States and from suppliers as far away as Australia and Europe. "We even get some pollen from

A Native American Dilemma

While most visitors overlook all but the most obvious environmental problems at the Grand Canyon—the thickening smog, the thunder of overflying jets—environmentalists and residents, particularly those from local tribes, ponder the impact of less visible threats: radioactive and heavy metal contamination from 8 uranium mines located to the north and 10 others to the south and east.

According to Robert Lippman, a Flagstaff lawyer and environmental activist, radioactive tailings were dumped from these mines during the 1950s and 1960s into the Animas, Dolores, and San Juan rivers, which flow into the Colorado. Radioactive sand still contaminates the canyon floor, he says, though no one has ever measured it—or its effects.

But environmentalists and tribal officials—in Arizona and elsewhere in the Southwest—point to a number of studies that they say confirm their suspicions. One study, conducted for the Navajo tribal government, found the rate of testicular and ovarian cancer among teenagers in three New Mexican uranium mining towns to be 15 times the national average.

Among those most affected by uranium mining near the Grand Canyon are members of the Havasupai and Hualapai tribes. Both groups are extremely poor, with unemployment rates among the 1,500 Hualapai sometimes reaching 70 percent. Not surprisingly, tribal backers of mining

claim that a strong uranium industry can provide jobs and, more important, a windfall from leasing agreements.

Yet opposition to uranium mining runs deep. In December, members of the Havasupai tribe, concerned about contamination of water supplies and desecration of sacred grounds, voted to ban mining on their reservation. The tribe had earlier joined environmentalists and the state's successful candidate for attorney general, Grant Woods, in opposing new mining on the south side of the Grand Canyon. For the majority of the Havasupai, religious and environmental concerns outweighed economic considerations. "We are guardians of the Grand Canyon," argues Rex Tilousi, a Havasupai Tribal Council member. "We are not supposed to allow any destruction."

Opposition to uranium mining in the Grand Canyon runs deep among local Native Americans such as Jennifer Siyuja (left), a member of the Havasupai tribe. Forgoing a chance to create desperately needed jobs, the tribe voted to ban operations like the underground uranium mine (below) at the Canyon's North Rim.



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Debates over uranium mining also stirred a controversy on the Hualapai reservation. In the late 1980s, tribal officials were negotiating with Denver-based Energy Fuels Nuclear (EFN) with an eye toward leasing uranium rights on their reservation. Supporters of such a lease saw mining as an easy answer to the tribe's economic problems. But when word got out, a group of tribe members led a campaign against the proposed mines.

Regardless of whatever precautions might be taken, they saw mining as a threat to their health, says Robert Little, the tribe's attorney general. A commission charged by the Hualapai government with drafting a new constitution joined the controversy and wrote a clause mandating popular approval of all resource agreements. Both sides in the dispute agreed to the clause, and negotiations with EFN came to an end.

Prosperity vs. Preservation

Despite the victories of Havasupai and Hualapai environmentalists and religious traditionalists, these and other tribes face a continuing dilemma frequently posed as a choice between prosperity and the preservation of a way of life. For many Native Americans, getting beyond this dilemma entails developing strategies that respect traditional economies while allowing the tribe to control assets and resources.

But doing so isn't easy. On the Hualapai reservation, for example, officials and residents admit that existing tribal businesses—a small hotel, a guide service, and a few other touristic operations—don't provide the jobs and income the tribe needs. Some officials want to expand the tourism industry, supporting the development of a resort hotel complex. But this proposal is rejected by many of those who oppose the uranium mines, and for similar reasons: they worry about the impact of such large-scale projects on the tribal culture. The dispute over uranium mining might be settled, yet the bigger questions remain.—JAMES B. GOODNO

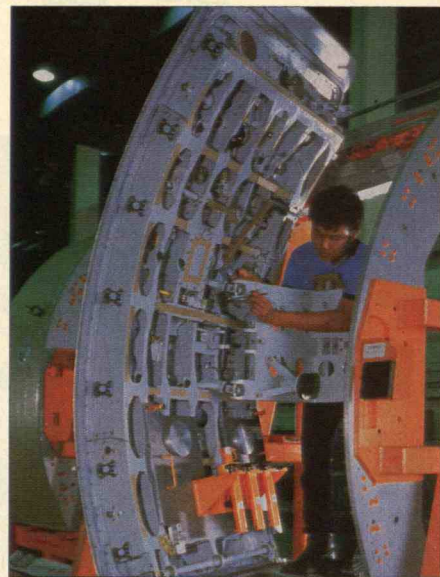
An Industrial Policy for Singapore

■ The government of Singapore is developing a hybrid industrial policy—blending government direction with market enterprise—that could inspire other industrialized nations both large and small to critically assess their indigenous resources and use them to best effect.

Under Singapore's National Technology Plan (NTP), the government will take a hands-on approach to steering Singapore's business community into several "strategic" technologies—through consultation, tax incentives, and direct investment in R&D—but decisions about what specific products to make and sell will be left to private companies.

Overseen by the National Science and Technology Board, nine committees of more than 200 business leaders, engineers, scientists, and government officials are looking at ways that government-financed research institutes could develop key industrial sectors. They have so far identified four promising technology areas: biotechnology, electronics, information science, and materials science for manufacturing.

One NTP subcommittee has already recommended a strategy for information technology and has targeted Singapore's software industry for investment. Recognizing that Singapore cannot compete in basic R&D with software industry giants—such as AT&T Bell Labs, developer of Unix (a leading computer operating system)—the subcommittee advocates a complementary approach focusing on the improvement of existing



If you can't beat 'em, join 'em: That's the strategy promoted by Chou Siaw Kiang (below), an architect of Singapore's new National Technology Plan. Rather than attempting to reinvent the airplane, Singapore Aerospace focused on winning a \$50 million contract to supply doors for the European Airbus (above).



software systems such as Unix.

Advocates of this approach point to companies such as Singapore Aerospace. In the 1980s, the company's management reasoned that because the cost of commercial and military aircraft was rising dramatically, many countries would decide to repair and upgrade their fleets rather than buy new systems. The firm therefore decided to manufacture replacement parts and other components that improve performance and fuel efficiency. Singapore Aerospace won a \$50 million contract to supply doors for the European Airbus, and it is helping to upgrade the U.S. Air Force F-5 fighter jet as well as commercial aircraft. The company says sales rose from \$85.4 million in 1985 to \$143 million in 1990.

For NTP to succeed, officials believe it will be essential for Singapore to attract and retain some 200 foreign scientists

and engineers each year as well as entice many of its own students into high-tech research. Thus, NTP's Manpower Development Group will offer \$100 million in scholarships and research assistantships for both international and Singaporean candidates.

Upgrading High-Tech Skills

These researchers will work in a new "technopolis" to be built along a 15-kilometer corridor, a \$240 million NTP project aimed at developing Singapore's R&D infrastructure. Modeled on "knowledge-based" communities that link academic and business research—such as California's Silicon Valley and France's Sophia Antipolis—the technopolis will comprise new laboratories, offices, computer networks, and social amenities. NTP officials hope the area will attract start-up companies and multinational corporations to work alongside scientists and engineers from Singapore University and national research institutes.

Some observers worry that NTP will be a huge waste of money—that its efforts will benefit multinational corporations far more than native Singaporean companies. Sanjoy Chowdhry, the Singapore-based chief economist of Merrill Lynch for the Asia-Pacific region, agrees that although the policy is not necessarily designed to favor larger companies, they still can compete more effectively than the smaller companies for NTP funds.

Others suggest that because it's impossible to monopolize the fruits of research, Singapore will foot the bill while other countries benefit. But, counters Chou Siaw Kiang, executive director of the National Science and Technology Board and an architect of the plan, "even if multinational corporations win many of our grants and use our R&D, they will develop and manufacture products here. This will upgrade the high-tech skills of their Singaporean employees. And it is with the skills of our people that we will compete."

—ROBERT CRAWFORD

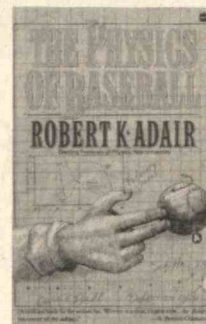


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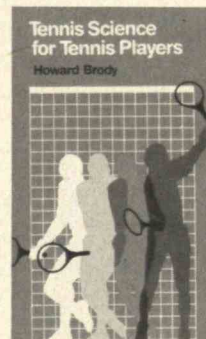
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The Candidates and The Issues

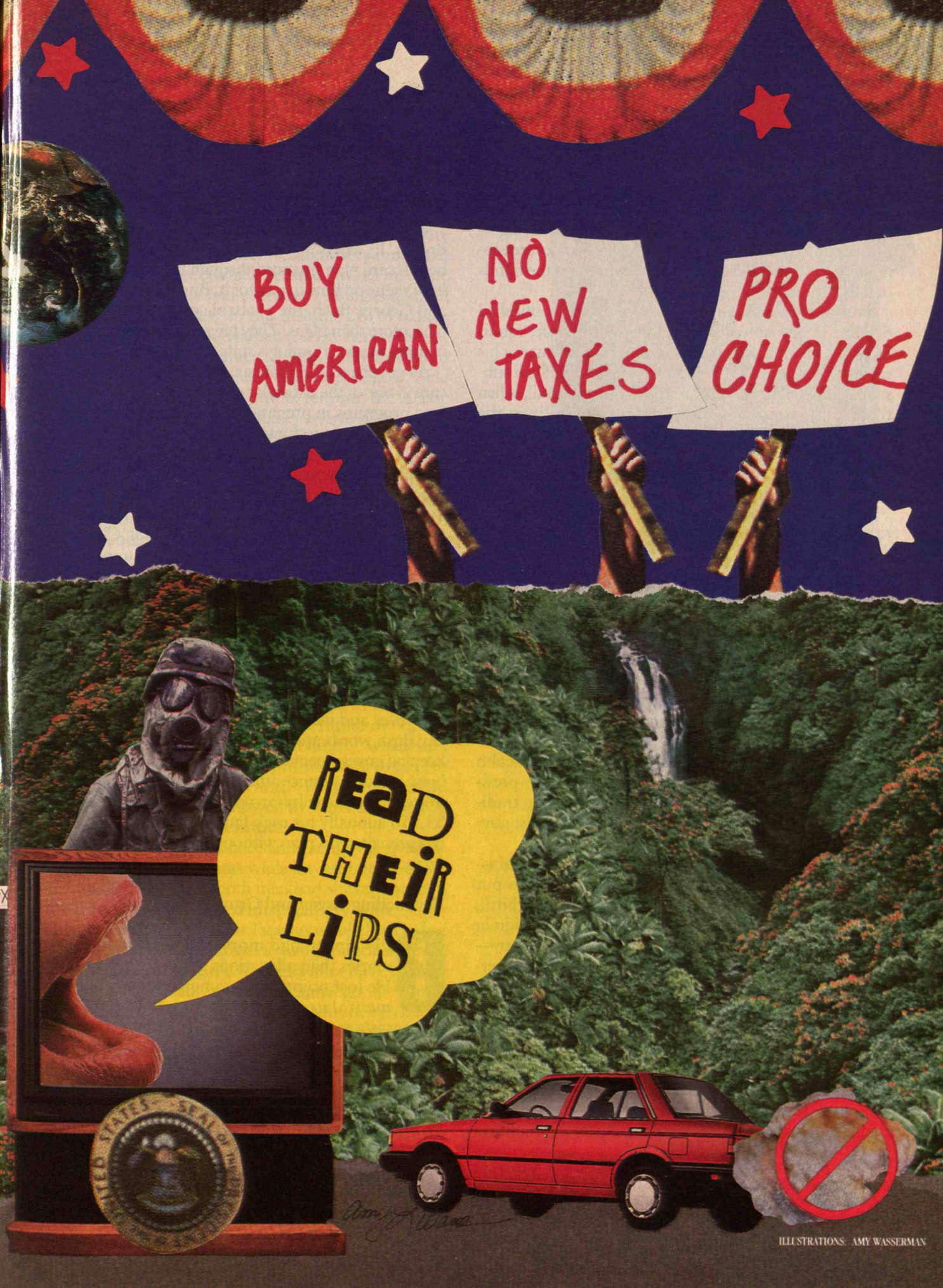
EDWIN DIAMOND AND JANE NEWMAN

RICHARD Nixon judged the 1988 Bush-Dukakis race a descent into “the trivial, the superficial, and the inane.” But halfway into the current election year, the race for the White House has produced some genuine public-policy dialogue.

Though the primaries have produced their share of tabloidy distractions, such as the Vietnam-era draft and the federal government’s funding of “pornography,” the presidential candidates, both Democratic and Republican, have also been addressing the unfinished business

**SO FAR, THE PRESIDENTIAL RACE
HAS ACTUALLY BEEN ADDRESSING
THE NATION’S BUSINESS.**





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READ
THEIR
LIPS



ILLUSTRATIONS: AMY WASSERMAN

of 1988 and the national agenda for the 1990s. Questions about industrial productivity, educational standards, military preparedness in a post-Soviet world, and the renewal of the nation's infrastructure and protection of its environment, among other issues, have been vigorously debated. There is nothing, it seems, like severe economic recession and voter discontent to focus the minds of the candidates.

Paul Tsongas and Bill Clinton, for example, published detailed policy statements (the Tsongas booklet ran to 86 pages, all text). George Bush similarly laid out his early campaign themes in old-fashioned print. Such substance may fall to the cutting-room floor this fall, when the presidential race takes place principally in the nation's living rooms and the candidates make their pitches in 10-second sound bites. Now, before we're hit by the full heat of campaign '92, here is some light from the more thoughtful moments of the primaries.

New Ideas on National Health Care

Health care was all but ignored in the 1988 presidential campaign. But then came the big pocket-book squeeze, while doctor bills and hospital costs continued to soar. Moreover, as the Democratic candidates have repeated mantra-like, some 35.7 million Americans under age 65 are without health insurance. So this time around, all candidates concurred on the need for a comprehensive national health-care plan.

While the Democrats were the first to push for health care reform, George Bush played catch-up. The president's stress was on market solutions, reflecting traditional Republican opposition to an interventionist government.

Nebraska Senator Robert Kerrey and former Massachusetts Senator Paul Tsongas did the most to put health care on the campaign agenda with thoughtful, detailed reforms. While Kerrey ended his campaign in March, he remains positioned to push his plan—"Health USA"—in the Senate. The plan calls for universal coverage to be funded by a 5 percent payroll tax, new corporate income taxes, and excise taxes on liquor and cigarettes. These taxes would raise a total of \$236 billion a year, according to Kerrey.

Paul Tsongas's "Health for All Americans" plan would guarantee coverage through employment-based insurance. Costs would be controlled through competition: health care providers would compete for contracts

from purchasing agents representing large groups of citizens. Tsongas's plan stressed prevention in the form of educational campaigns aimed at smokers and alcohol and drug abusers.

Former California Governor Edmund G. (Jerry) Brown, Jr., offers a "Family Bill of Rights"—a national health care plan financed through the tax system—but he is vague on how to pay for it. By contrast, Bill Clinton and George Bush, the probable opponents in the fall, have more than plans. They have records open to examination, the one running a state and the other, a country.

As governor of Arkansas, Clinton improved health care in one of the nation's poorest states, beginning with new programs in prenatal care and care for poor children. Clinton is nothing if not the candidate brimming with new paradigms and "re-inventions of government." He proposes to base national health care on the model of the "German and other European systems." Translation: an activist role for government, as opposed to reliance on private insurance plans. Still, Clinton can show the courage of his convictions; he supported the Arkansas Health Department's successful campaign to distribute condoms to Arkansas high-school students through school clinics. Such a course was politically risky in the presumptive Bible Belt across the nation's midsection.

George Bush presents health care reform as "building from our strengths"—insurance for all Americans that preserves and increases opportunities for choice. The key Bush words are consumer choice, quality care, and keeping government out of the picture. He would make basic health insurance affordable for low-income people not covered now by providing a tax credit of up to \$3,750 annually for each family. But like Brown, Bush has presented his plan without offering any firm way to finance it.

Reconciling Green and Growth

Bill Clinton had more on his mind in the primaries than allegations about his personal life. He lost points with some voters and environmental groups on his record in protecting Arkansas's environment. The Institute for Southern Studies, a research group based in Durham, N.C., ranked Arkansas last in the nation in its "green index," which measures the severity of environmental problems and the rigor of regulatory enforcement. The Arkansas Pollution Control and Ecology Commission was "stacked with representatives of some of the biggest polluters in the chemical, poultry, and paper industries," *Newsweek* reported. Clinton, in effect, pleaded no contest, frankly acknowledging that economic growth took

EDWIN DIAMOND is a professor of journalism at New York University and director of its News Study Group. JANE NEWMAN, a member of that group, is a graduate of NYU's Science and Environmental Reporting Program.

precedence over the environment during his 11 years as governor.

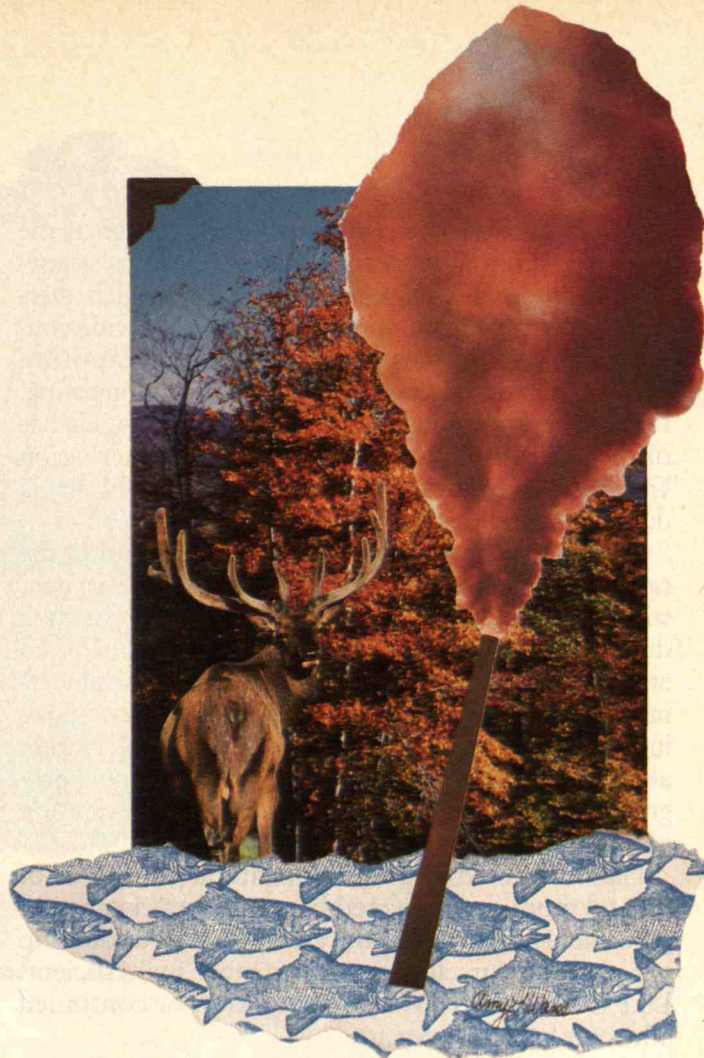
Paul Tsongas has a long record as an environmental activist. He chaired the first congressional hearings on global warming and acid rain, served on the Senate Energy and Natural Resources Committee, and introduced the amendment (which became law) to mandate testing of automobile fuel-efficiency. Tsongas favored "incremental increases" in the gasoline tax to reduce energy consumption and wanted federal incentives that encourage utility companies to meet energy demand "by greater efficiency instead of greater supply." He also advocated preserving and extending the Arctic National Wildlife Refuge on Alaska's north slope.

But Tsongas offended some Greens with his support of the U.S.-Mexico free-trade agreement; because regulatory enforcement is less strict in Mexico than in the United States, environmentalists fear that an agreement would encourage industrial development in Mexico without requiring standards on a par with those north of the border.

Environmentalists' biggest problem with Tsongas, however, was that he was the Democrat most supportive of nuclear power. When pressed about nuclear power plants in the televised debates, Tsongas said he supported research on safer, smaller options; he also declared that he did not now support construction of new plants. But in his pamphlet, "A Call to Economic Arms," Tsongas clearly said that the future of nuclear power is "in the 300-500 megawatt range," which isn't so small. The handbook also praised the French for their reliance on nuclear power: "They have decided upon a course which if followed by other nations will render the Persian Gulf less critical."

Clinton immediately pounced on Tsongas as an advocate of nuclear power plants while leaving out the qualifier "smaller." In truth, both men had shaved the facts significantly. Clinton talked imaginatively of the "hundreds" of nuclear plants that Tsongas would build—but without mentioning Arkansas's own pronuclear stance during the Clinton years. Tsongas may have the last word, though probably not in this campaign. As a "pro-growth, pro-business" Democrat who nevertheless worries about a carcinogenic world, he deftly couched the case for nuclear power in the phrase "a necessary evil."

Jerry Brown and Tom Harkin remained the only energy purists. Brown has endorsed the development of geothermal, solar, wind, and other alternative energy sources to wean the United States from its dependence on fossil fuels. He wants to phase out all nuclear power over 10 years and develop high-speed rail lines to break the automobile's chokehold on the central city.



**CONCERNED ABOUT
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PRESIDENT."**

Brown's concrete record belies his reputation as the flaky "governor moonbeam." During his terms as governor, California was a leader in developing such alternative energy sources, and he created a statewide conservation corps—a volunteer group promoting environmental awareness through wildlife monitoring, trail upkeep, and similar preservation projects. He has offered the idea of a national Civilian Conservation Corps modeled after his California group, in turn a descendant of the Roosevelt-era CCC.

Although Senator Tom Harkin dropped out of the race in March, his ideas were attractive to a Green constituency: he favored global standards to reduce carbon dioxide emissions, beginning with cuts in the United States of one-fifth over the next 15 years; improvements in water quality; an emphasis on recycling and composting; and measures to reduce the loss of topsoil. Harkin also tried to begin discussion of a family-planning program to slow population growth and reduce strains on global resources and the environment.

Harkin favored greater use of natural gas instead of oil and more cars powered by natural gas instead of gasoline. He also urged the auto industry to develop vehicles that run cleaner and are more fuel-efficient. Like Kerrey, he'll have opportunities for continued advocacy in the U.S. Senate.

The Greens' biggest disappointment was George Bush. Although during the 1988 campaign he claimed he wanted to be the "environmental president," Bush did little to live up to his self-proclaimed title. He may not even accept his own invitation to the U. N.'s Earth Summit in Rio de Janeiro this June. Bush has refused to commit the United States to an international treaty to control carbon dioxide emissions that may be signed by other nations in Rio.

The "case of the lost wetlands" illustrates the conservative, as opposed to conservationist, approach of the Bush administration. Bush promised "no net loss" of wetlands in the 1988 campaign. The president's Council on Competitiveness, chaired by Vice-President Dan Quayle, then changed the definition of the term and removed protection for about three-quarters of the nearly 100 million acres of remaining U.S. wetlands. Only an adamant stand by the Environmental Protection Agency prompted the council to retreat.

The Bush administration favors oil drilling in the Arctic National Wildlife Refuge. It also shies away from stricter auto fuel-efficiency standards and shuns a petroleum tax intended to reduce auto use and the emission of greenhouse gases. But given widespread demands to revitalize the economy, the Democrats haven't really campaigned vigorously against the nonenvironmental president. Meanwhile, Bush has

boldly gone in the prodevelopment direction; in January, he ordered cabinet departments and federal agencies to institute a 90-day moratorium on any new regulations that "could hinder growth."

Education for the Next Century

As in health care, Bill Clinton has a record to run on: while governor of Arkansas he improved state education programs, and even his critics acknowledge his successes. The percentage of high-school seniors bound for college rose from 38 percent in 1984 to 48 percent in 1991. Clinton initiated a competence test for Arkansas teachers (which displeased teachers' associations), and he mandated smaller classes and instituted a statewide exam that eighth grade students must pass before moving on to high school. Funding for the new Arkansas education programs came from a one-cent increase in the sales tax.

If elected, Clinton pledges to provide preschool day care for every child and full funding for Head Start. He also endorses a national examination system for elementary and secondary students and proposes annual evaluations of state, district, and schoolwide programs. He would set up a national work-study program, coordinated by high schools and local businesses, to help train students who are not going on to college. For those who are, he pledges financial assistance: he would create a national trust fund that students would repay as a small percentage of their future income or with a few years of voluntary national service as teachers, police officers, or child-care workers. He would dedicate a portion of the putative peace dividend to finance these ambitious programs. Finally, Clinton wants to establish a nationwide adult literacy program in which employees could earn a general-education diploma at their workplace.

Education policy was not at the core of Paul Tsongas's candidacy; being the probusiness Democrat was. But he had the right applause lines when he equated the nation's economic health with its educational health. Speaking to the board of directors of the National Education Association, Tsongas recalled his own experiences teaching in the Peace Corps in the 1960s: in "backward" Ethiopia, he noted pointedly, teachers had greater status than in the United States.

Tsongas advocated merit pay and new standards of teacher competence. He promised to be a tough schoolmaster—"the president must be the principal-in-chief," he said—ordering up longer school days and more parental involvement. And although he proposed a student loan program funded through federal income tax, he also saw a new role for noneducators such as business leaders, citing the "intervention" of philanthropist



PAUL TSONGAS
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Eugene Lang in his Bronx junior high school. (Lang pays full tuition for all graduates who go on to college.)

George Bush has talked more about education but has accomplished little. Bush and Secretary of Education Lamar Alexander unveiled in April 1991 their "America 2000" education strategy, which set out to achieve six ambitious "national education goals" by the start of the new century. The first goal is to have "all children start school ready to learn"; toward that end, Bush promised full funding of Head Start programs. America 2000 also aims to achieve a 90 percent high-school graduation rate, establish national teacher-competence tests, make U.S. students first in the world in science and mathematics achievement, attain 100 percent adult literacy, and—the perennial wish-list item—ensure drug-free and violence-free schools.

Bush makes the conservative argument that education has not improved despite increased funding: total spending for elementary and secondary schools more than doubled since 1980 while the size of the student population remained the same. If anything, he claims, the liberals' practice of "throwing money at problems" has actually made matters worse. America 2000 promises to create 535 new schools "to meet the demands of a new century"—one in each Congressional district would be developed with limited federal

support for start-up costs. "Research and development partnerships" consisting of private corporations, universities, think tanks, management consultants, and others would work with the schools. Despite these ambitious plans, when the Democrat-controlled Senate turned down the America 2000 plan in late January, the president mounted no real counterattack.

Redirecting Defense Dollars

U.S. industries now receive tax credits for funds they invest in R&D; George Bush proposes to make these tax credits permanent. He plans to increase spending for civilian R&D by 7 percent, to \$30.4 billion, while holding the defense R&D budget firm. Bush has proposed budget hikes for big-science projects, including \$650 million for the Superconducting Super Collider—an increase of 34 percent.

Assuming that Boris Yeltsin can deliver on his promises to eliminate all land-based multiple-warhead ballistic missiles under Russian control, Bush has replied in kind, saying the United States will eliminate all MX missiles. Bush would also eliminate multiple warheads on Minuteman missiles and reduce the number of warheads on U.S. sea-based missiles by about one-third.

Bush has already ordered a "stand down" of a large part of the U.S. strategic bomber fleet; for the first time since the coldest days of the Cold War, nuclear-armed aircraft no longer prowled around the clock. The Pentagon will complete 20 B-2 (Stealth) bombers, at a cost of \$850 million per plane, and then stop further production. The "small ICBM" program would be shut down. Independent of Yeltsin, Bush promises no more production of warheads for sea-based ballistic missiles. The United States has already stopped production of the MX missile and is not ordering any new cruise missiles.

But all this leaves the nation's defense-based industries with a need for something to do. In a second term, Bush promises that new weaponry would still be developed in prototype but not put into full production. Some \$6 billion to \$8 billion of the Pentagon's \$291 billion budget would be saved in the 1993 fiscal year when the production lines shut down—the actual "peace dividend." Further, space and defense contractors are being supported by the administration through those big-ticket, big-science projects, including the space station and the Strategic Defense Initiative.

The Democratic candidates, without exception, argued that the pace of reducing defense spending post-Soviet collapse is too slow, especially given the importance of civilian R&D in economic recovery. Like Bush, all advocated an R&D tax credit, but they would replace much of the Bush defense R&D budget with civilian programs.

Bill Clinton says the United States can cut defense spending by over a third by 1997 and make do with a smaller Army and Navy, reducing conventional U.S. forces in Europe well below the Pentagon's projected levels. He wants to replace the present military structure with "a smaller, more flexible mix of capabilities to meet new threats." He would stop production of the B-2 bomber. He wants a "civilian DARPA," modeled after the Pentagon's Defense Advanced Research Projects Agency, where former military men and women will be able to find challenging work.

Brown proposes to cut military spending in half in five years; to ease the pain of job losses, he would promote strong federal investment in infrastructure—for example, rebuilding seaports to enhance U.S. trade overseas.

To help U.S. industry compete, Tsongas said he'd encourage cooperative ventures involving business, government, and universities to develop new technology. He talked up the need for a system that would disseminate important technologies and ideas from other nations to U.S. businesses. To aid in U.S. manufacturing,

he would offer both investment and R&D tax credits. In his administration, he promised, not only would the Boston area's Route 128 rise again; Route 128s would girdle the country.

Interestingly, appeals to fears of Japanese economic power have played a relatively small part in the primaries. That may change when the big industrial states in the Northeast and Midwest are contested in the fall.

George Bush continues to support the doctrine of global free trade—he has been careful to use the narrower term "fair trade"—and to reject protectionism. He has not been afraid to challenge the Japanese on some restrictive market practices. For instance, during his ill-starred trip to Tokyo earlier this year, Bush tried to get the Japanese to commit themselves to "target" numbers of U.S. auto imports.

But the Democrats have been much more confrontational. Bill Clinton argues that the United States can expand its economy by insisting that Japan and Germany do their part to maintain global economic growth. Specifically, Clinton would push the Japanese and Germans to purchase more U.S. exports. He also speaks of greater "burden sharing"—Japan and Germany should be paying more of the costs of their own security.

Paul Tsongas, presenting himself as the only candidate daring to speak unpleasant truths, argued that the only way the United States can compete internationally is by improving the quality of its own products. He opposed trade restrictions as counterproductive—but even he drew a protectionist line in the sand. Without demonizing the Japanese, he nevertheless argued that foreign companies should not be allowed to take over "strategic" U.S. industries, otherwise unspecified.

Neither did Tsongas shirk from assigning the federal government a major role in making U.S. industry competitive. Reflecting perhaps the historic links to manufacturing of his home base of Lowell, Mass., Tsongas spoke of the need for an industrial policy—he wanted the government to invest in emerging technologies, backing "winners" while deep-sixing "losers."

Brown's tone of "I'm mad as hell and I'm not gonna take it any more" is apparent in this area, as in others. His slogan—"Take America Back"—sounds anti-Japanese, but he is an equal opportunity name caller; protectionist CEOs, he says, are cry babies.

Dealing with AIDS

All the candidates promise to do more about AIDS. Only Paul Tsongas got down to specifics early in the campaign, calling for more research funds and an "open and honest" federal AIDS

policy "to save lives, not appease the homophobic right." AIDS activists described Tsongas's views as the most aggressive and detailed of all the candidates. He was the only candidate to use the words "gay rights" in his standard stump speech in the early primaries. As long ago as 1979, before the AIDS epidemic and before gay and lesbian voters were considered a well-organized voting bloc, first-term Senator Tsongas introduced the first national gay rights bill.

By contrast, Bill Clinton has felt some animosity from gay and lesbian groups. As governor, he signed the Arkansas law requiring that people with AIDS (as well as those who are HIV-positive) be reported to state health authorities. Arkansas state law also permits AIDS testing without consent and prosecutes so-called "high-risk behavior."

The Bush administration has treated AIDS much like the previous Reagan administration: both provided some funds for research and treatment but did not mobilize mainstream opinion or promote a sense that the national leadership really cares. Reagan said nothing about AIDS until his friend Rock Hudson was stricken. Bush has been similarly silent, and now more than ever has a conservative constituency to appease.

As indifferent as the Bush White House may seem on the issue, its sentiments are mild compared with those of Pat Buchanan, the conservative columnist and television commentator turned Bush nemesis. AIDS, Buchanan wrote in his syndicated column, is "nature's retribution" against homosexuals.

Buchanan has had nothing else substantive to say on matters of science and technology. His campaign purportedly set out to recapture the "soul" of the Republican party, and not too many people took his presidential bid seriously—though millions used it to "send a message" to the White House. Thus Buchanan succeeded in pushing Bush to the right; for example, the president fired his appointee to the National Endowment for the Arts after a televised Buchanan attack on NEA's funding of a "pornographic" art film.

Although the Buchanan sideshow has threatened to drag the campaign down to the disgraces of 1988, campaign '92 has actually achieved the primaries' basic purposes: First, push the candidates beyond sound bites to articulate their messages in full. Second, give the party electorates a chance to size up the messengers. And finally, move the nation toward a referendum on where it's going and what goals it holds highest.

As long as the candidates continue to debate policy rather than porn, there is reason to hope that campaign '92 will continue concentrating on the urgent national business of the 1990s and beyond. ■

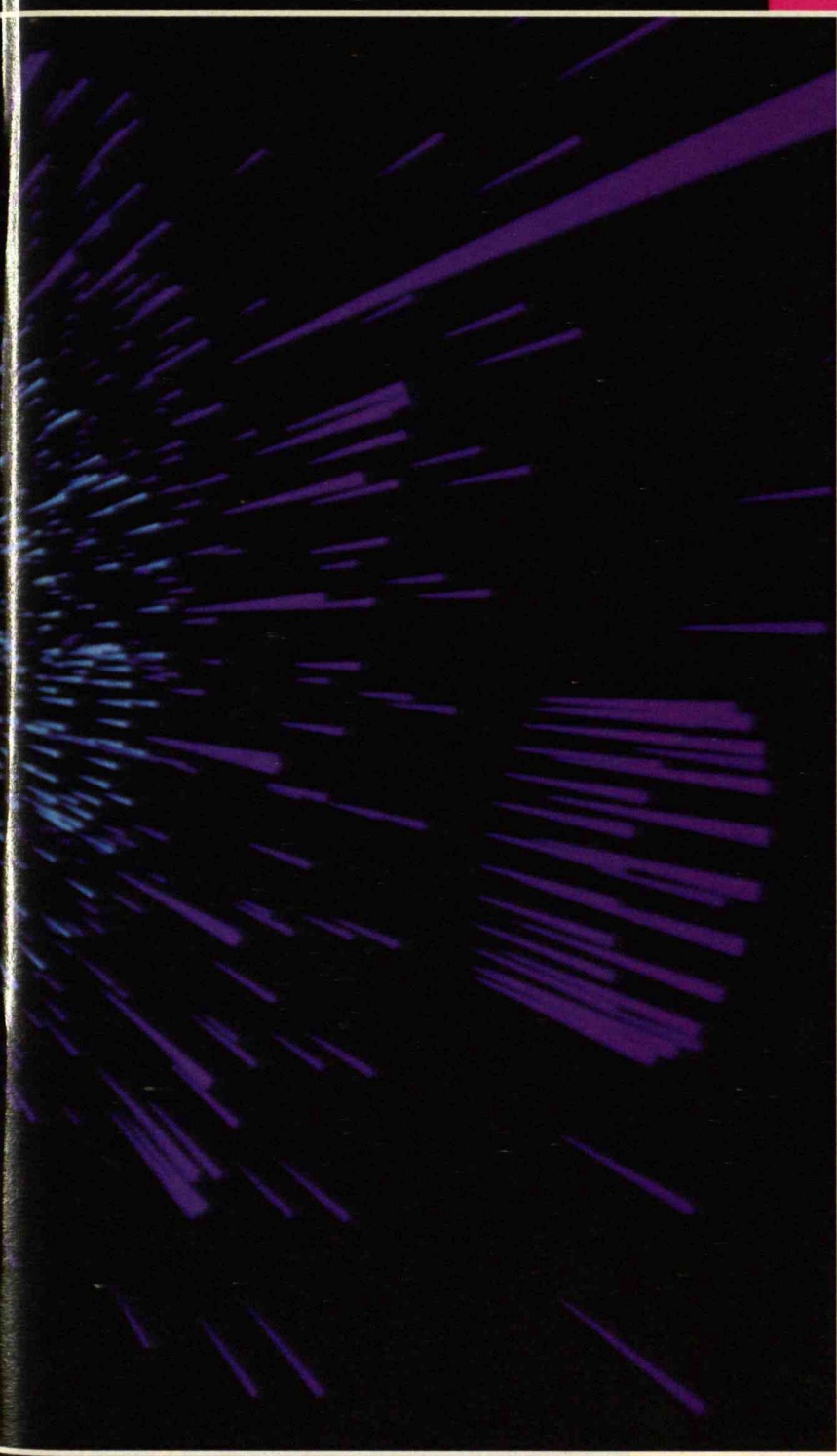


**ALL CANDIDATES
CONCURRED ON THE
NEED FOR A
COMPREHENSIVE
NATIONAL HEALTH
CARE PLAN.**



A Picture Is Worth 1,000

Researchers are flocking to computerized "scientific visualization" as a merciful and



NUMBERS are the stock in trade for virtually all scientific fields, but so many are being produced that they often overwhelm the researcher. Discerning patterns in data can be a tedious and time-consuming task. To the rescue, once again, is the computer, which can digest mounds of data and spit them out in sharp, graphic forms. Instead of having to pore through millions of numbers representing different stellar particles, astrophysicists can see the effects of two neutron stars colliding. Likewise, atmospheric scientists can detect a relationship between the ozone hole above Antarctica and atmospheric circulation patterns, and biologists can observe how a cancer-causing molecule distorts a section of DNA.

Left: Astrophysicists use computer graphics to model the flow of stellar matter during a simulated collision of extremely dense neutron stars. The material with the lowest density (purple) streaks away first, while that with the highest density (orange) lingers longest.

Numbers

BY LAURA VAN DAM

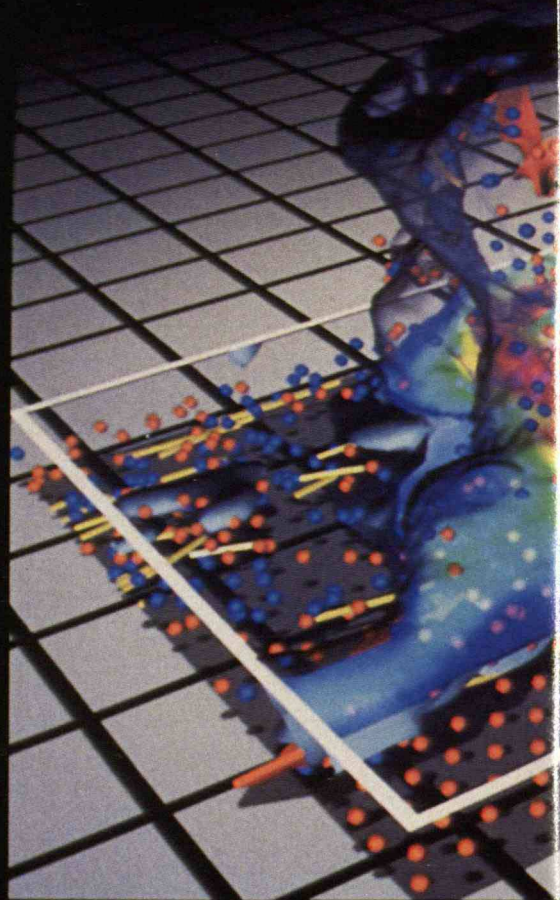
valuable substitute for data overload.

PROponents of scientific visualization, the branch of computer graphics dedicated to conceptualizing research results, claim a correspondence between the human brain's highly developed visual abilities and the power of computer images that incorporate many variables.

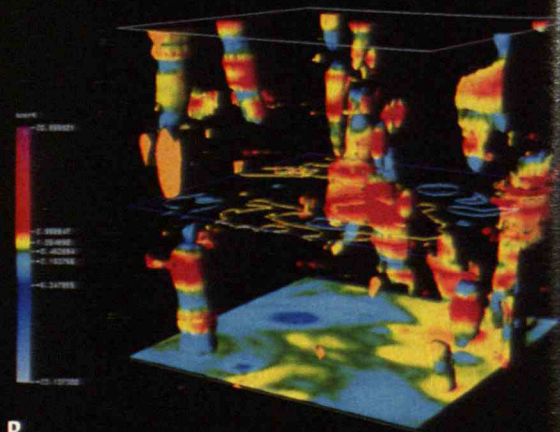
Producing a computerized image first requires software that plugs numbers into appropriate equations. A second program then plots the results onto the axes of a two- or three-dimensional graph. Depending on the complexity of the image a researcher wants to develop, software also assigns results to other "dimensions" such as colors and shapes.

The capacity of scientific visualization is growing hand in hand with computing power. Supercomputers are making it possible to develop animations that reveal changes over time. Computer-graphics specialists are experimenting with assigning sound as well as color and shape to numbers. Researchers are also beginning to rotate, slice, or otherwise manipulate pictures of data. And images can be made to appear realistic with lighting, shadowing, and other special effects originally introduced for the entertainment industry.

For most researchers today, however, it is the plummeting cost of computing power that really makes a difference. As more scientists acquire computer workstations, they are developing graphics relevant to their work. In some cases, desktop computers can do the job.

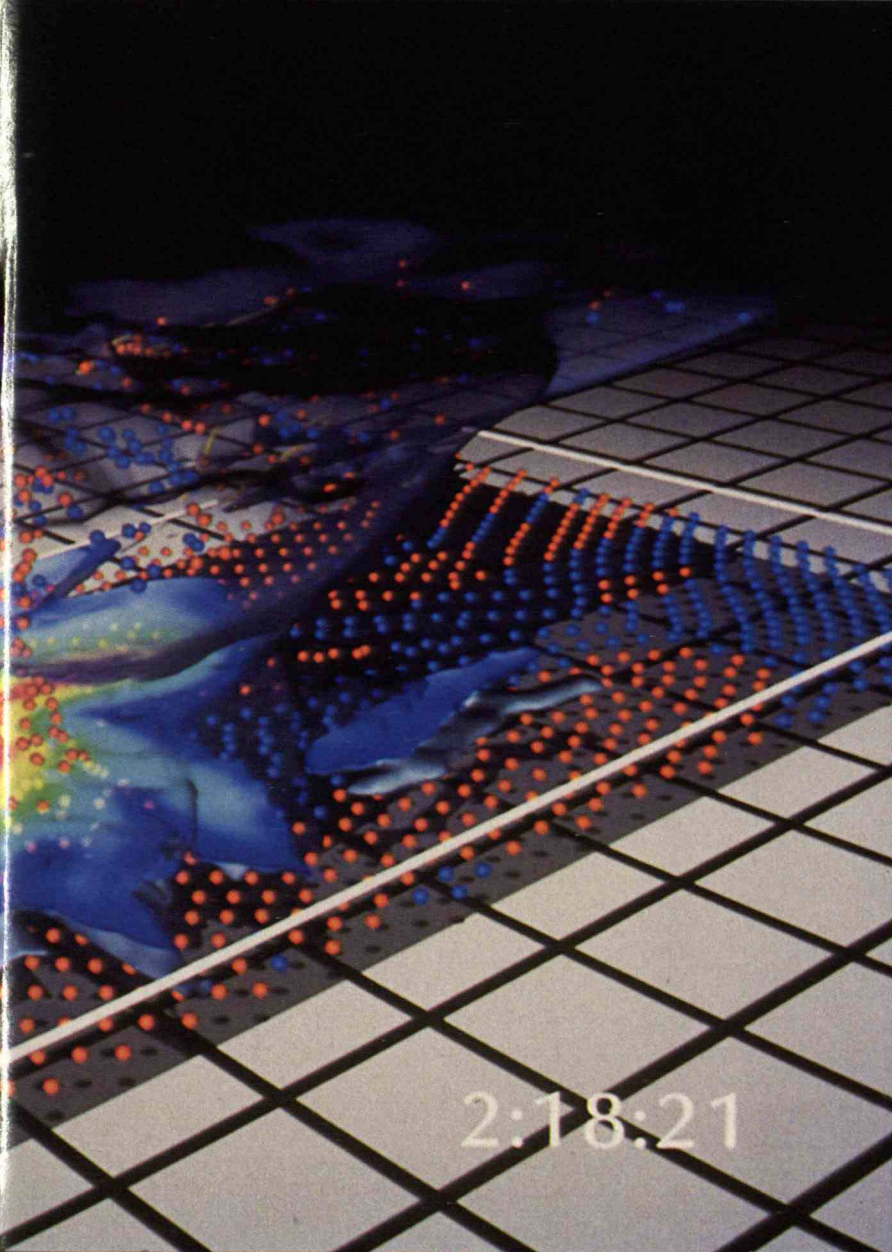


A

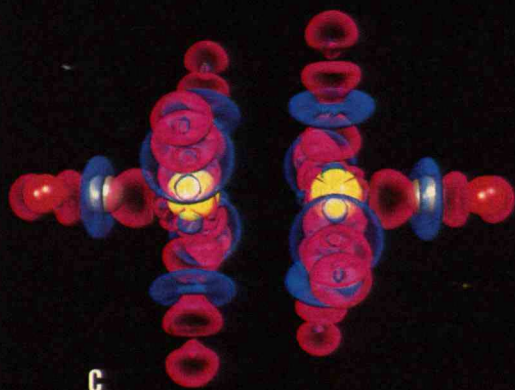


B

Laura van Dam is a senior editor of Technology Review.

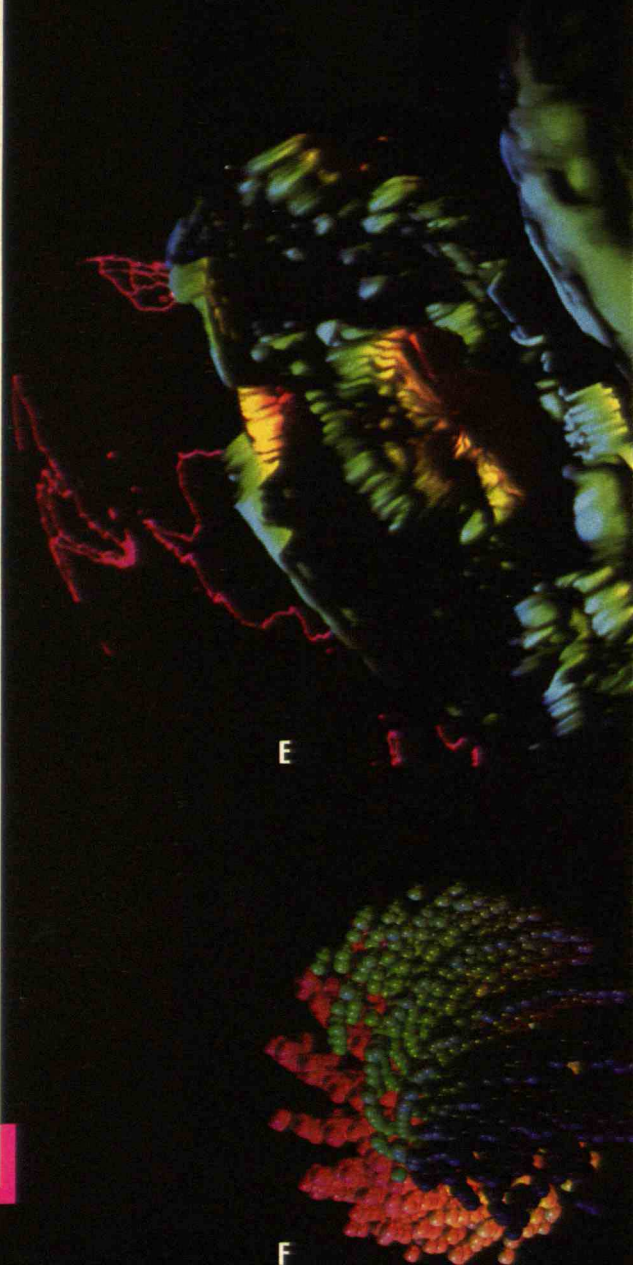


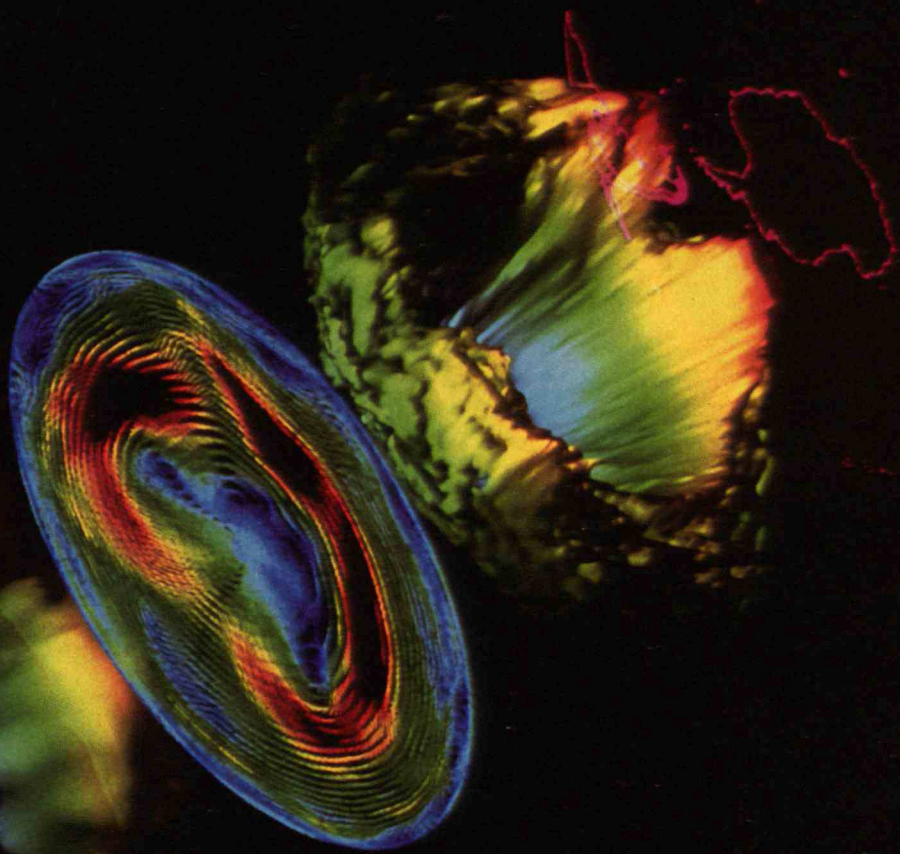
A: Computer images incorporating many variables can help researchers analyze complex processes. The graphic visualization of a numerical model of a thunderstorm, including storm rotation and various kinds of wind and rain, can improve weather forecasting of severe storms. The twisting orange ribbon in the center represents a rotating updraft of air often associated with tornado development. B: The slice across the center of this image shows the flow of the Gulf Stream's main current and its offshoots; the colored columns depict vorticity. C: Scientific visualization can enable researchers to spot inaccurate models easily. This image should show a connection between the two manganese elements (yellow) in the chemical. The absence of electron density (transparent red surfaces) between those elements indicates an error. D: Scientific visualization can also highlight important variations in data. The red spikes in this image of the greater Los Angeles area indicate levels of ozone pollution higher than federal standards.



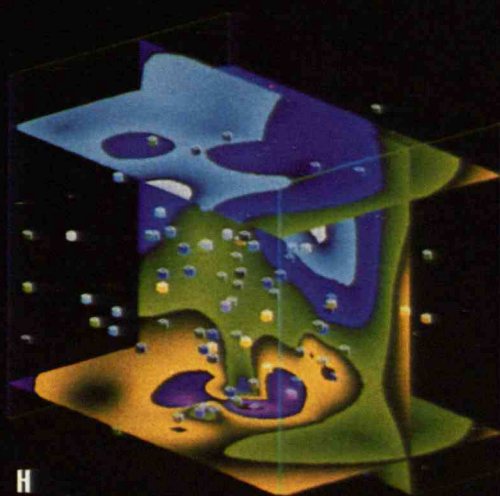
SCIENTIFIC visualization could become more widely used once software can free researchers from having to work closely with computer programmers to produce graphics, says Scott Dyer, inventor of apE, a highly regarded visualization program. And Carl Machover, a computer-graphics consultant, speaks of the need to boost the relatively small amount of data that can now be sent at one time between workstations and supercomputers, the link used to produce the most sophisticated graphics. Change will come as workstations become still more powerful—enabling them to do much of the requisite processing on their own. Computer scientists are also trying to develop ways to send fewer data over existing lines and compress the data for easier delivery. The high-speed fiber-optic network that Congress might fund would also help.

Still, as the images on these pages suggest, scientific visualization has already become an important research tool for many disciplines. Among the fields that can “no longer exist” without computer graphics, says Michael Bailey, manager of scientific visualization at the San Diego Supercomputer Center, are molecular modeling, computational chemistry, astrophysics, and semiconductor design. Just five years ago it was “a bit odd to find scientists buried in their workstations,” says Andries van Dam, a computer science professor at Brown University. Today “everybody is doing it. It’s by far the best way to look at your data.”

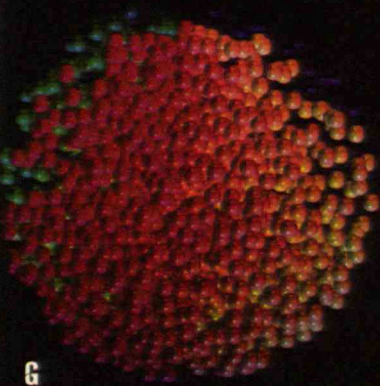




E: To study the hole in the stratospheric ozone layer over Antarctica, IBM researcher Lloyd Treinish sandwiched four images between a stretched map of the Southern Hemisphere. From left to right, the maps represent the topography of the region's land and ocean areas, temperatures in the upper troposphere (lower atmosphere), horizontal wind directions in the troposphere, and the amount of ozone in the stratosphere (upper atmosphere). Computer graphics that include tropospheric data can help explain the physics of the ozone hole's formation. F. G: Random-number generators, used for studies such as of a molecule's random diffusion in water, don't always live up to their name. A program depicting the generators' output as balls on a three-dimensional grid, with colors arranged to aid depth perception, can reveal patterns, which imply a poor random-number generator. A lack of patterns indicates a good generator. H: Even researchers in fields such as psychology are using scientific visualization. This image made from data taken from personality tests of 100 California criminals plots self-control (and, by inference, non-violence) as a function of manic, psychopathic, and depression factors. Blue indicates the greatest amount of self-control, red the least. The dots represent the individuals from whom the data were gathered.

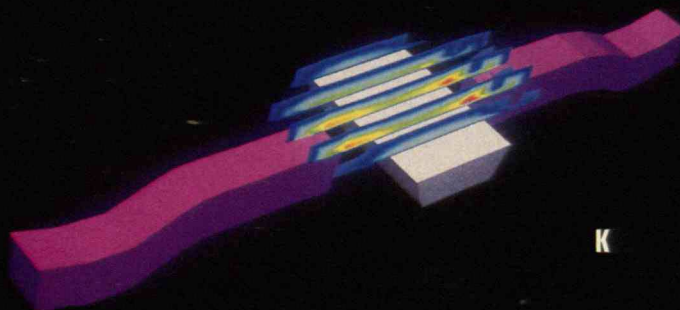
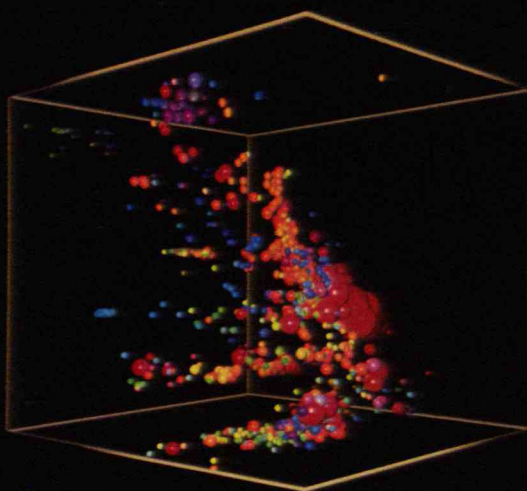
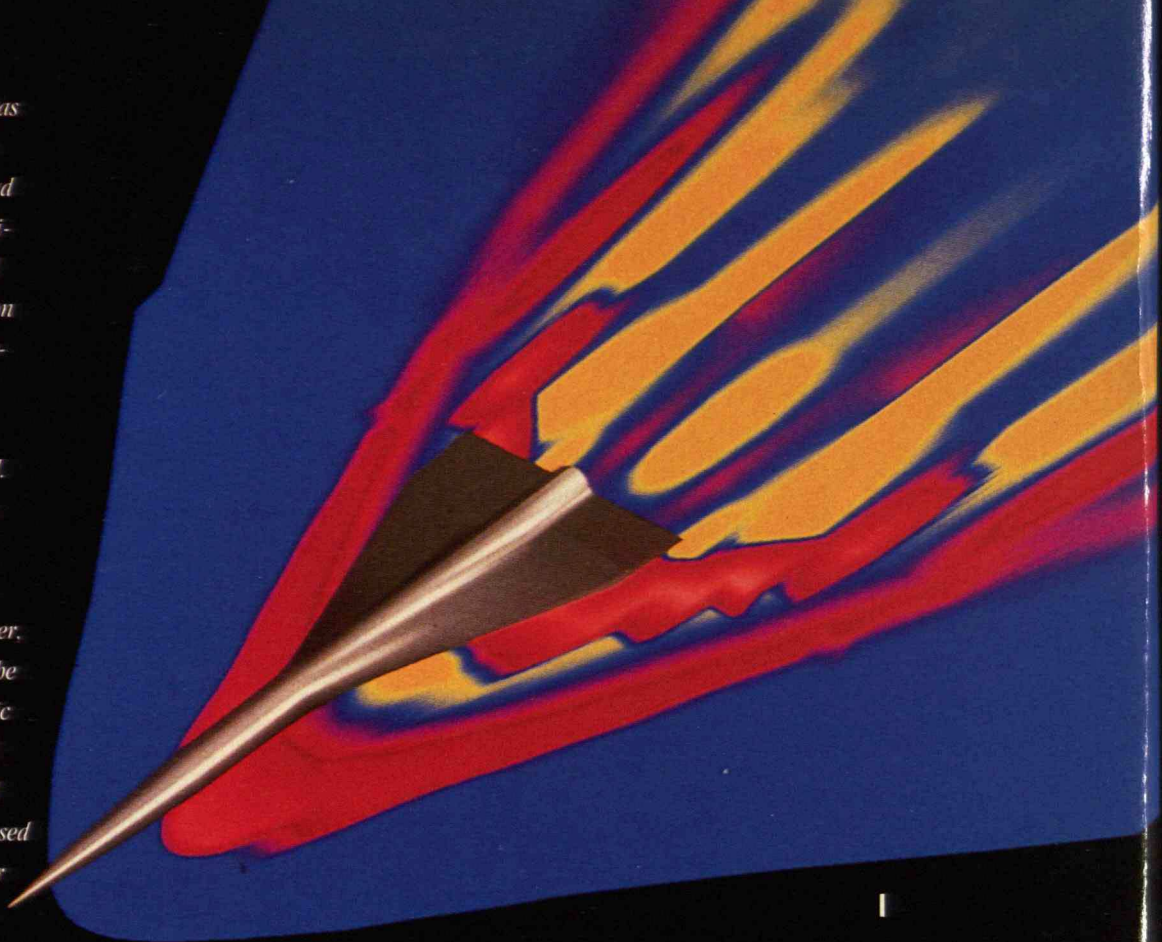


H



G

Scientific visualization also has industrial applications. I: To support research at Boeing and McDonnell Douglas, NASA engineers created a computerized image of air pressure acting on a model of a supersonic transport (SST) plane. Variations indicate where sonic booms would be heard on the ground. (Blue represents atmospheric pressure, red higher-than-atmospheric pressure, yellow lower.) The conclusion: thinner, more arrow-like wings than the Concorde's would reduce sonic boom significantly and could pave the way for SST overland flights. J: Oil producers have used visualization to identify water chemistry in oil-rich regions. This image represents a large area containing deep underground water in the western U.S. The balls' colors reflect the chemical composition of water in different locations, suggesting rock types and nearby fluid movements. The large red balls in the center, which indicate high salinity, and the smaller balls beneath suggest that oil or fresh water could be trapped below. K: Computer-chip manufacturers regularly use simulation technology to see how semiconductor devices perform. This graphic of a MOSFET (metal-oxide semiconductor field-effect transistor) shows current flow under the gray "gate" and between the purple "source" and "drain." Red indicates maximum flow.

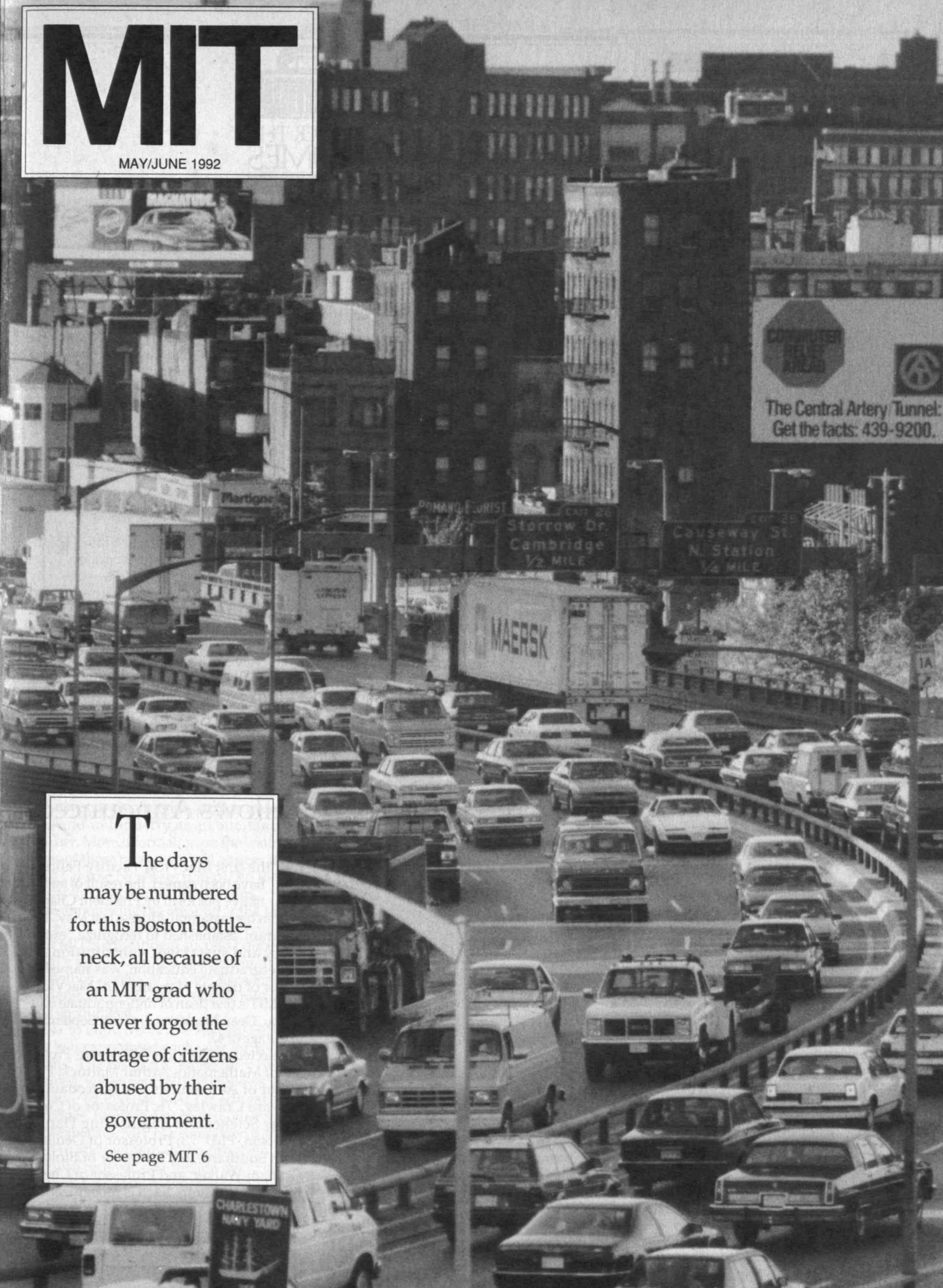


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MIT

MAY/JUNE 1992



The days
may be numbered
for this Boston bottle-
neck, all because of
an MIT grad who
never forgot the
outrage of citizens
abused by their
government.

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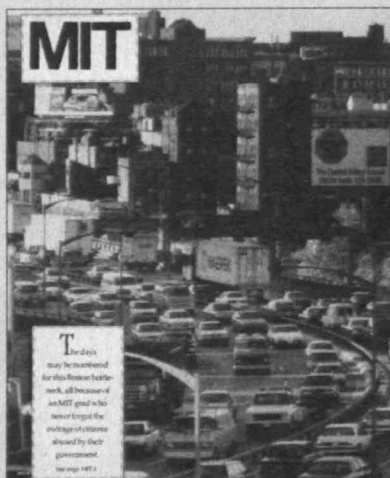
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Cover photo:
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Research Institute Founder Dies

Edwin C. (Jack) Whitehead, life member of the Corporation and founder of the Whitehead Institute for Biomedical Research, died February 2 after suffering a heart attack during a squash game. He was 72 years old and lived in Greenwich, Conn.

Whitehead was co-founder, with his father, of Technicon Corp., a pioneer in scientific and clinical instrumentation. They began Technicon with a \$5,000 loan in 1939, in a one-room office in the Bronx. In 1980, the company was sold to Revlon, Inc., in a stock and cash exchange in excess of \$400 million. Technicon is often credited with having created the modern clinical diagnostics industry.

Some time later, Whitehead approached Nobel laureate David Baltimore, '61, with his vision of an independent basic research institute. Together, they developed a plan and forged an affiliation between the nascent institute and MIT. The Whitehead Institute was founded in 1982 with \$135 million, the largest single gift ever made to American science. Its 250 scientists, housed in a building in Kendall Square, all hold faculty appointments at MIT.

Recently, Whitehead explained his decision to start the institute: "Since I had earned the money from advances in medicine, I wanted to create a premier biomedical institution with the resources necessary to produce the finest research possible, all the while sheltering it from outside forces that might compromise its efforts."

Over the next 10 years, Whitehead's support for the institute never flagged. He visited often and rejoiced in its scientific achievements. Although he had no official role, he was always eager to act as a sounding board for the institute's administration and the board of trustees.

At the same time, he worked to promote

public understanding of the biomedical sciences on the national level. He founded and chaired the board of directors of Research!America, an organization devoted

to focusing the entire nation on the urgency of investing in medical research. Since 1982, he had also been chair and founding partner of Whitehead/Sterling, a private investment and asset management firm in Stamford, Conn.

Whitehead received the Van Slyke award from the American Association of Clinical Chemists for his contributions to clinical chemistry and laboratory diagnostics. He was the only recipient of that award who held neither an MD nor a PhD degree. His

other awards include honorary degrees from New York Medical College and the University of Bridgeport, and the Golden Plate Award of the American Academy of Achievement. □

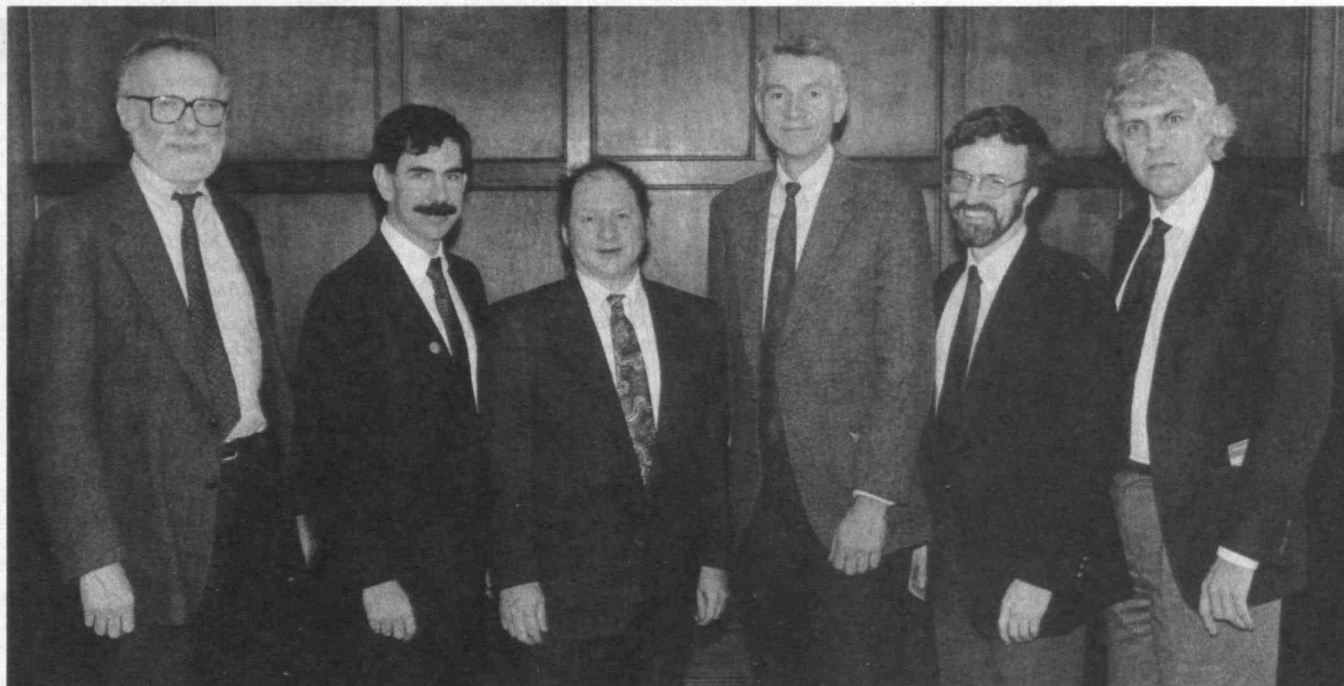


Jack Whitehead

First Teaching Fellows Announced

The first MacVicar Faculty Fellows have been named, the result of an initiative put forth by President Charles Vest in his inaugural address last May. The program, established to recognize "exemplary and sustained" contributions to undergraduate education, was named in honor of the late Margaret L.A. MacVicar, '65, MIT's first dean of undergraduate education. Dean MacVicar died last September at the age of 47.

Selected as MacVicar Fellows are Professor of Mathematics Arthur Mattuck; Professor of Aeronautics and Astronautics Edward Crawley, '76; Professor of Computer Science and Engineering Harold Abelson, PhD '73; Professor of Geology John Southard, '60; Professor of Biology Graham Walker; and Professor of Chemistry Daniel Kemp. Each is recognized by



The new MacVicar Faculty Fellows are, from left: Arthur Mattuck, Edward Crawley, Harold Abelson, John Southard, Graham Walker, and Daniel Kemp.

current and former students, fellow faculty members, and colleagues at other universities and in industry as an outstanding teacher. More information on the contributions of these professors will appear in the July Course News section of the *Review* under their respective departments.

In announcing the creation of the Faculty Fellow program last spring, Vest said that MIT's educational success "depends, above all else, on the commitment and inventiveness of our faculty. Excellence in undergraduate teaching must be rewarded and encouraged."

Six to eight MacVicar Faculty Fellows are to be appointed each year for 10-year terms. The program, when fully implemented, will support 60 to 80 Fellows. Each receive \$5,000 per year for educational activities, research, travel, and other scholarly expenses. MIT has committed \$10 million in endowment to the program, and has also received a \$1 million gift from the Exxon Education Foundation. Dean

MacVicar served as a director of Exxon Corp. from 1985 until her death. □

James Named To Head Council

Vincent W. James, '78, a member of the Educational Council for 10 years, has been appointed director of the Council and associate director of admissions. He succeeds Bonny S. Kellermann, '72, now associate registrar.

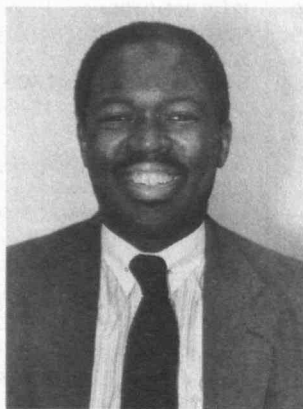
As Educational Council director, James will coordinate the program through which MIT alumni/ae interview high school seniors who have applied to MIT for admission.

James, who received an SB in chemical engineering, was a Karl Taylor Compton Prize recipient. He received an MBA degree in management from Rutgers University in 1990. He comes to MIT from the Bankers Trust

Co. of New York City, where he had worked since 1985 as a systems leader in Corporate Accounting and Information Systems. He has also been a programmer analyst with Tangent International Computer Consultants, Inc., of New York City, and an engineer and analyst with Procter and Gamble Co. of Cincinnati.

An active alumnus, James served as president of the MIT Club of Cincinnati and as a director of the MIT Club of New York. He was a member of the MIT Alumni/ae Activities Board for two years and the Technology Day Committee for four years.

After eight years in New York, James says he enjoys being back on campus and plans "to continue to maintain the excellent communication mechanisms that were in place during Bonny's tenure. In the short term, I want to assess how the educational counselors spend their time and listen to their recommendations as to how the office can be more supportive." □



Vincent James



ALUM- NEWS

MIT Clubs Are Alive and Well and Awaiting Your Membership!



cross the nation and around the world, MIT Alumni Clubs draw thousands of alumni/ae, parents, students, and friends to a broad range of social and educational activities. Since MIT clubs reflect the diversity of our alumni/ae body, events range from faculty speakers to career workshops, from plant tours to cabaret shows, all in an effort to promote the Institute and provide enlightenment about its programs. In addition, a number of clubs have a public service entity in which one may find people tutoring high school students or painting a shelter for battered women.

Club leadership is drawn from local alumni/ae volunteers who serve as officers or board members and often rise to positions on Alumni/ae Association national boards and committees. Each club sends out annual membership invitations, usually with their first fall mailings. Look for your invitation next fall or respond now by looking up the club president or alumni/ae staff person in your area.

We look forward to seeing you soon and often at MIT Club activities.

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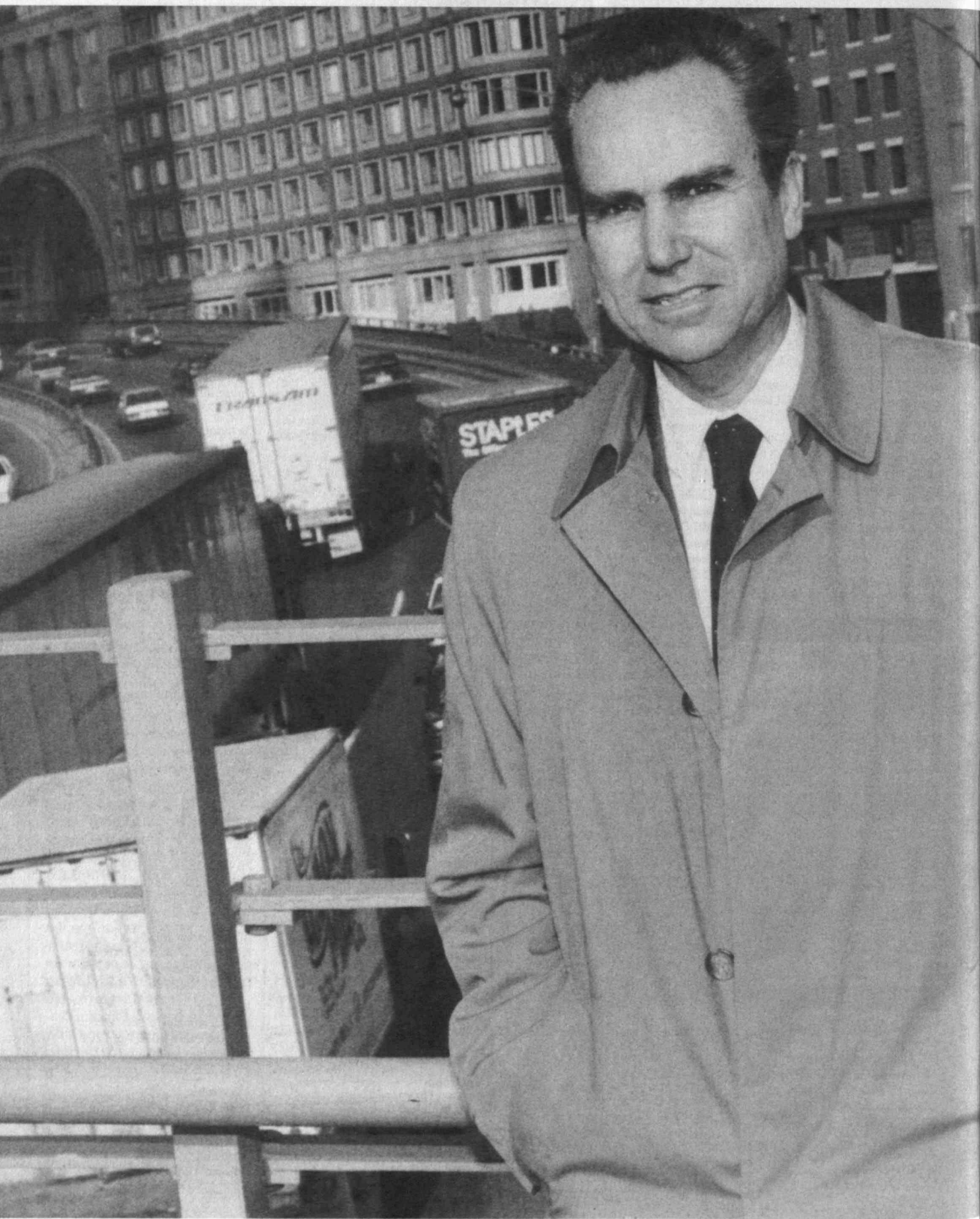
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FRED SALVUCCI '61

A Transportation Planner Who Saves Neighborhoods

BY LESLIE BRUNETTA



**Totally immersed in
Boston culture and
geography, Salvucci
developed a feel for
community, compromise, and the critical
importance of
transportation that
would transplant
to any city.**

Sure, Frederick Salvucci, '61, SM '62, is proud of the big plaque in Cambridge's Porter Square MBTA station that lists him as the Massachusetts Secretary of Transportation responsible for extending the Red Line past Harvard Square. Thousands of commuters headed for downtown Boston or Cambridge can now leave their cars at the Alewife Station near Fresh Pond. Thousands more can drop theirs off at stations along the Fitchburg commuter rail line and transfer to the T at Porter.

But Salvucci says he's more proud of a small plaque at Porter dedicated to the memory of Pompeo Leone, a builder killed in a ditch collapse during the station's construction. "Pompey was a *paisan* of ours," Salvucci says, "and it meant a lot to me that we had a small ceremony to remember him when the station opened. Usually it's just the officials who get the attention when projects like this are finished, but it takes guys like Pompey to make it happen."

Coming from many government officials, that sentiment would sound like pure politics, like the kind of false modesty and solidarity with the little guy that voters are supposed to love. But with Salvucci, you get the feeling it's real.

He's been in and out of the state limelight for close to 20 years now, first as the hero of mass transit when most other transportation experts said it was dead and later as the mastermind and principal promoter of Boston's Central Artery highway project, a magnet for controversy. But the first thing you notice when you meet him is that he seems shy, almost tentative about projecting himself. Gradually, though, he

reveals himself a man of passions, passions that revolve around a trinity of extended family, all things Italian, and the transportation system he sees as supporting life in Boston, the city he loves. Salvucci made the same tribute to two other workers who died in accidents during Red Line construction, but as he talks, you know the effort he made for Leone was something *di cuore*, from the heart.

Salvucci could easily have been one of the men working alongside Leone. "Just about everyone in the family was a construction worker," he says. In fact, by the late 1960s, his father, Guido, had built his bricklaying company into the largest masonry subcontractor in New England. Growing up in

Boston's Brighton section, Salvucci started working with his father when he was 10 and liked the life. But his parents had different ideas.

"Construction people want their kids to be engineers," Salvucci says. "I remember when I was a little kid, my mother pointing to MIT and saying, 'That's the best engineering school in the world and maybe someday you can go there.'" Things seemed to be going his parents' way when Miss Fellman, Fred's junior high music teacher, steered him into Boston Latin School.

As Salvucci tells the story, though, he nearly derailed the adults' efforts: "When you went to Latin you had to sign a paper saying you intended to go to college. I didn't want to sign it because everybody in the family quit school at 16 and went to do construction. My mother spent hours—she was a saint—explaining that it wasn't dishonest to sign the paper, that I could be a

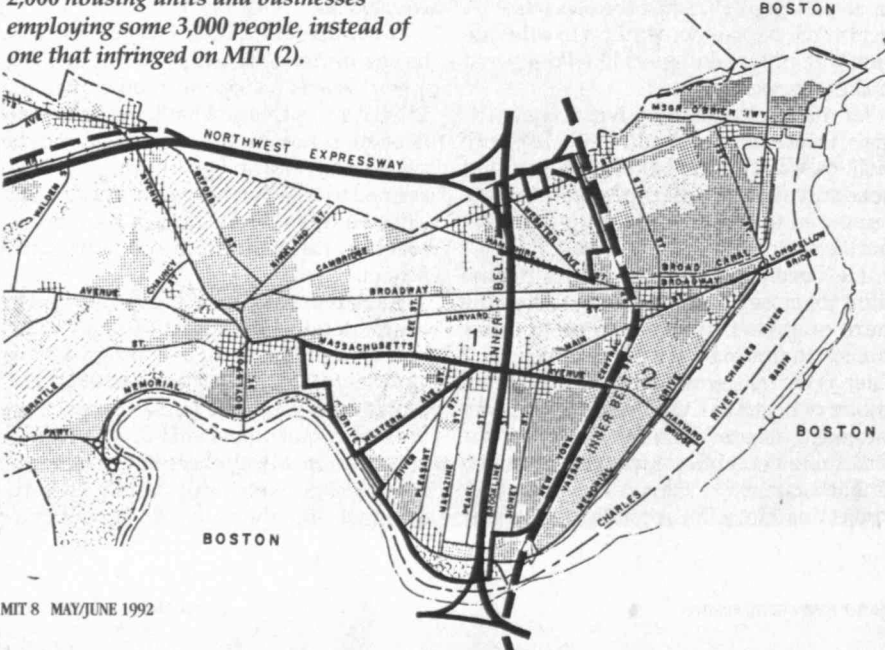
bricklayer with an engineer's degree but I couldn't be an engineer with a bricklayer's card." He finally signed on, and Latin's academic rigor prepared him for entrance to MIT.

Originally undecided whether to major in architecture or civil engineering, Salvucci remembers an architecture assignment that suddenly made up his mind for him: "We were supposed to be building a house for a very rich person on Martha's Vineyard, and one of the specs was that there was a separate little house for the children because this guy didn't want his kids in the house." As he tells this story some 30 years later, Salvucci still sounds outraged. "I said to myself, I am *not* going to work for crazy people, catering to this nonsense. Forget it, I'll be an engineer."

He was interested in the workings of cities and figured that specializing in transportation issues could help him stay closer to his roots. "I thought, I'll find a way to work for the government and I'll be able to affect the way people live."

In an upper level civil engineering course taught by Professor Scheffer Lang, '49, Salvucci learned that serving the public is more complicated than just building public works projects. The assignment was to design a dam for the government of Haiti. The advice from Salvucci's team:

Salvucci was a long-time opponent of plans to extend Routes 2 and 95 through Cambridge and link them to an extended Massachusetts Turnpike by means of an Inner Belt highway. As a student, he had been particularly indignant that many of his fellow engineering students favored an Inner Belt "alignment" that would have cut through Central Square (1), leveling 2,000 housing units and businesses employing some 3,000 people, instead of one that infringed on MIT (2).



build the biggest dam possible. "We gave the standard engineering answer, 'BIGGER IS BETTER!' he growls in mock monomania. "More flood control, more agricultural water, more everything."

But Lang wasn't impressed: "He told us, 'You can't just do what some two-bit dictator wants you to because he gets his name on the dam. You could bankrupt the country and starve people.' My first reaction was, Lang's got to be *wrong*. He talked about the interest rate, and I thought that's just a bunch of banking nonsense, it doesn't deal with human needs. But he said there are just so many dollars—a dollar spent on the dam is not spent on education. He made mincemeat out of us. And I realized I better learn some of this economics stuff, this is important. So I studied economic analysis and how to make decisions in public works, which was the subject of my master's thesis."

Meanwhile, events around Boston showed Salvucci just how relevant this lesson was to his own community. As suburbs blossomed around the Northeast's cities following World War II, most policy makers decided that bigger highways were always better. Salvucci's grandmother's house stood in the way of the Massachusetts Turnpike extension, so it was seized and demolished. "They gave her *one*



Of the 20 years

he spent on the Artery

Project, he notes:

"In Southern Italian, the

word for work is

fatiga. You've got

to keep at it."

dollar," he says. "They didn't even give her an estimate on the value of her house for six months, and this is a 70-year-old widow who doesn't speak English. I mean, this was the government of the people treating her this way; it was outrageous. And the people at the community meetings giving the non-answers, treating people atrociously, were civil engineers. I was furious—furious for my grandmother and furious that I was going to be an engineer and part of all this."

Salvucci's impression of civil engineers wasn't helped by an MIT class

discussion about how to select the "alignment," or path, through Cambridge for the proposed Inner Belt highway, which was on the drawing boards from 1948 to 1973. It was to link the proposed extensions of the Turnpike and Routes 2 and 95. (See map.) One alignment cut through Central Square and sliced out an estimated 2,000 housing units and businesses employing some 3,000 people. Its alternative ran much closer to MIT. "The MIT alignment was much less disruptive," says Salvucci. "But everybody in the class said, well, of course, that's out of the question and the right answer is Central Square. How could that possibly be the right answer?"

The Birth of an Activist

His first professional job was as a transportation planner at the Boston Redevelopment Authority (BRA). He worked there 1963-68, with a year off, under a Fulbright Scholarship, to study the transportation component of a government program to stimulate economic development in Southern Italy. On their return from Italy, Salvucci and his wife, Mary Ann, moved into the top floor of his parents' Brighton three-decker, and they've lived there ever since.

At the BRA, Salvucci lived a kind of double life. His boss, Edward Logue, favored the proposed highway extensions into the city, and part of Salvucci's day job was to analyze the impact the new highways would have. It was solid engineering work, and Salvucci enjoyed it. But at night and on weekends, he joined community groups trying to block the new highways and the

neighborhood demolition they would require.

Salvucci sent Logue a memo detailing what he was up to and offering to leave the BRA if Logue wanted. "I completely understand if it embarrasses him—he's a good man and I don't want to do that." Logue's friendly reply suggested that the young engineer keep his job and drop the activism. "And I said, well, no, that's not an option," Salvucci chuckles. "If Logue wants me to stay, that's nice, but I'm gonna do what I'm gonna do at night." Logue diplomatically let it go.

Soon after his inauguration in 1968, Boston Mayor Kevin White launched the Little City Halls program, in which City Hall "outreach" offices were eventually opened in 14 neighborhoods. Some White advisers had spotted Salvucci at the BRA and community meetings and convinced the mayor he would be a perfect manager for the first Little City Hall, in heavily Italian East Boston.

In his new post, Salvucci quickly came up against Logan Airport expansionism and Port Authority arrogance; you can still hear the ire in his voice when he talks about the impact they had on East Boston. The Port Authority planned a new runway that would route jet traffic over the neighborhood and was running hundreds of trucks down residential streets unnecessarily. Taking the community's side against that scheme turned out to be one of White's first political victories. Salvucci—who pushed for some time before City Hall heard him and his Eastie constituents—found that he now had some political prestige of his own.

That new clout ensured a better hearing for his views on the highway extensions. By late 1969, Salvucci and other White advisers had convinced the mayor to come out publicly against the Inner Belt highway and everything that went with it. Eventually, Massachusetts Governor Frank Sargent was also convinced, and the projects were shelved.

If Salvucci is remembered in years to come, it's likely to be for the Central Artery/Tunnel project, in which downtown I-93's capacity will be almost doubled, its currently elevated sections rebuilt underground, and the Massachusetts Turnpike extended to Logan through a third harbor tunnel. Already underway and estimated to cost \$6.5 billion, the Project is one of the largest public works ever undertaken in the United States.

Salvucci says that it will unstick the worst bottleneck in the entire Interstate



highway system, promote economic development in old industrial areas of South Boston now covered by parking lots, and significantly improve the environment in Charlestown, East Boston, Cambridge, and all along the downtown ribbon where the elevated Artery now stands. And not insignificantly, the Project will keep the heads of thousands of architects, engineers, construction workers, and suppliers above water during the recession.

The thing is, not everyone believes him. The Project has been called everything from a pork-barrel retirement present for retired Speaker of the House Tip O'Neill and a federal subsidy for Boston real estate barons, to a recipe for unprecedented traffic backups, intolerable air pollution levels, and rat stampedes for the 10 years work is expected to be in progress. In Cambridge, where Salvucci believes his efforts to ax the Inner Belt should have ensured his reputation as a champion of neighborhood interests, he has instead been skewered as the champion of Scheme Z, a proposed Charles River crossing for I-93 in an industrial area of Cambridge. And, as he raced to wrap up authorizations for the Project in his final hours as the head of transportation, Salvucci was accused in the press and elsewhere of anti-democratic manipulation of the regulatory process.

Can Mass Transit and Highways Co-exist?

What generates the bile sluicing through many local discussions about the Project, though, is simply that it's a highway project, a way to get cars and trucks through Boston faster. "What most surprised me," says Cambridge city councillor and former mayor Alice Wolf, "was for someone like Secretary Salvucci, who started out interested in public transportation, to spend so much of his political capital on massive highway projects. In Cambridge,

A classic shot from Boston's City Hall Plaza in the late 1980s. Left to right: Paul Eustace, secretary of labor; Salvucci; Governor Michael Dukakis; Fred's father, contractor and bricklayer Guido Salvucci; and Charles Razo, business manager of the Bricklayers Union in Boston—all on hand for the annual bricklayers' apprentice competition.

we're facing parking freezes; we *have* to get people out of their cars. The \$6 billion slated for the Artery would have been enough to fund all the mass transit projects we've been thinking about for years." Wolf is not alone in her opinion. Now that his once-heretical claim—that inner-city highways are bad and public transportation is good—is practically dogma, critics want to know why does he, of all people, want to double the size of the Artery? Has he finally joined the "bigger is better" crew?

Salvucci, of course, says he hasn't. People who think the Central Artery Project as a whole—not just one or two of its components—is a bad idea do so, he believes, because they see it as a single project, as an end in itself. Salvucci sees it instead as one of the last major pieces of the Boston Transportation Planning Review program begun in 1970. When Governor Sargent convened the Planning Review, Salvucci, then transportation advisor to Mayor White, served as the Boston representative. Salvucci believes that the review resulted in a "brilliant" metropolitan area policy that recognized the city as a vital environment, a place in which people live and work rather than as the place they flee at 6 p.m. to return to the suburbs.

The general goals emerging from the review were, on the one hand, to have fewer cars downtown while, on the other hand, to allow ready access to and



Salvucci commissioned this statue of A. Philip Randolph, the founding president of the Brotherhood of Sleeping Car Porters and a civil rights activist, for the new Back Bay/South End MBTA station. Because it acknowledges the history of both neighborhoods, it was a piece of art that everyone could support.

through the city for "rubber wheel trips" that couldn't practically switch to rail: trucks taking shipments to and from Logan or the docks or making deliveries to city residences and businesses, ambulances and other emergency vehicles, and some cars. The review led to concrete prescriptions to scrap the above-mentioned highway extensions, add lots of mass transit capacity, limit parking downtown and at Logan, and address the unsightly, clogged Central Artery.

"The center of the transportation system was and is totally congested," Salvucci says, "and it made sense to invest in highways to expand that capacity at the center without bringing more traffic into it. But the balance of the whole system relied not just on freedom from congestion at the center but also on massive improvement in the quality of public transportation and limitation of parking downtown. That fundamental game plan has been followed since the early '70s, but it's happened over such a long time that people have forgotten that there was one, cohesive plan."

For the person on the sidewalk, the elevated Artery means noise, dirt, and dark-

ness. What's worse, the highway has never worked well as a piece of transportation infrastructure. From the time it opened, it carried nearly twice its designed load of traffic. And the helter-skelter layout of its entrance and exit ramps practically invited accidents. Still, Salvucci thought that contractor William Reynolds, '49, was crazy when he first tried to talk Fred into tearing the Artery down. "Reynolds said that the Artery was so bad, it was like a giant billboard against road-building, which was his business," Salvucci remembers, "and the only solution to the congestion was to put it underground and widen it."

Putting the Artery underground wasn't a new idea. "Halfway through building it as an elevated highway," he explains, "they realized it was a mistake and started building it underground near Chinatown." But it struck him as unthinkable that Bostonians and state and federal transportation agencies would accept life without the Artery for the years it would take to build the new tunnel.

Eventually, though, Reynolds convinced Salvucci that a tunnel could be built under the Artery while leaving the old highway open for traffic. Salvucci says he became fascinated with the idea, believing that if the engineering problems could be worked out, many of mistakes of the past could be rectified. When he first took Reynolds' idea to Kevin White in 1971, White told him that it had been his own idea all along to depress the Artery. When Salvucci took "White's idea" to the *Boston Globe*, an editor told him that depressing

the Artery had been *his* idea. But even with such powerful interests in his camp, it would be two decades before the "big dig" got underway.

Meanwhile, through the rest of the 1970s, Salvucci tackled the mass transit component of the Planning Review. He represented Boston on a commission studying the financing and structure of the Transit Authority, and their work led to increased state funding for public transportation. As a result, the MBTA is less dependent on fares than transit systems in most U.S. cities, allowing it to keep fares lower and to make longer-term plans for capital improvements.

Ideas + Authority = Action

During his first stint as secretary of transportation and construction and Michael Dukakis's first term as governor, starting in 1975, Salvucci was in a position to make sure that the policy recommendations in the review were implemented. Some of the biggest MBTA capital improvements in decades began during that period.

The two men met when Dukakis was one of the few state legislators questioning the Master Highway Plan that included the Inner Belt. "There was nobody from the engineering and planning world who was opposed to the master plan," Dukakis recalls. "Finally somebody told me to look up this young engineer with an MIT degree who had just come back from a Fulbright in Italy." They found that they were in total agreement on highways and mass transit, but in the early '60s, Dukakis remarks, "it was a lonely crowd."

As secretary, Salvucci extended the Red Line to Alewife on one end and added the Quincy Adams/Southeast Expressway regional station to the other. His Orange Line plans were even more ambitious. Rather than just refurbish the crumbling El from Chinatown to Forest Hill, he and others worked out an \$800 million scheme to move the Orange Line underground and over to the Southwest Corridor. They plugged mass transit into a right-of-way that had been shaved of houses for one of the shelved highway extensions.

The new plan allowed not only the development of the Southwest Corridor Park, the building of larger, safer T stations, and relief from the El's gloom in Roxbury and Jamaica Plain, but also new connections between the T and the commuter rail and Amtrak lines. A long-term program to upgrade the commuter rail system was also launched.

"I think one sign of how well the Orange Line worked out is that the South End and

the Back Bay kept arguing about who got to claim the new Back Bay/South End station," Salvucci says. Salvucci has a sentimental attachment to this station, too. The plans included funding for artwork. A controversy developed, he says, because Back Bay residents wanted a sculpture that recognized a Back Bay artist—John Singleton Copley, for example—while the South End wanted a traditional African work that acknowledged the history of blacks in that neighborhood. The solution to the controversy revolved around the fact that the black porters who boarded their trains at the old Back Bay station had settled in the South End and helped to stabilize the neighborhood. Salvucci saluted both neighborhoods by commissioning a statue of A. Philip Randolph, the founding president of the Brotherhood of Sleeping Car Porters 1925-68 and a leading civil rights activist.

When the statue was finally unveiled in 1988, Salvucci and Dukakis honored 23 retired railway porters with certificates and a ceremony. "That made me feel good," says Salvucci. "One, because we got a compromise people liked. But mostly because when we tracked these elderly gentlemen down, they all said that nobody had ever recognized them before for how they helped to build the railroad. Some of the speeches they made just really made you feel like crying."

When Dukakis was voted out of office in the 1978 primary, Salvucci came to MIT's Center for Transportation Studies as senior lecturer and research associate. Being out of government for the first time in 15 years was invigorating, Salvucci says, but he never stopped chewing at the Central Artery idea. When Dukakis was reelected in 1982, Salvucci returned as secretary of transportation and launched serious efforts to make the depression of the Artery a reality. That meant developing the conceptual plan, building community support, securing the necessary environmental approvals from state and federal agencies, and lining up federal funding.

Dukakis was already on board, and it didn't take too long to convince the powerful Massachusetts congressional delegation—and a significant portion of the downtown business community—that the Artery was a "good thing" and would add millions of dollars and thousands of jobs to the local economy. Once the lawmakers accepted responsibility for winning federal funding, Salvucci personally had little control over the outcome.

Still, most observers of the process agree that he was a valuable player. Salvucci is well known for holding his own under tough questioning, for being patient, for keeping a sense of humor, and for explaining technical points in language that draws a clear picture for the non-technician. And most important, he was intellectually and morally convinced that the Project would improve the Boston environment. If you've ever talked to Salvucci about the

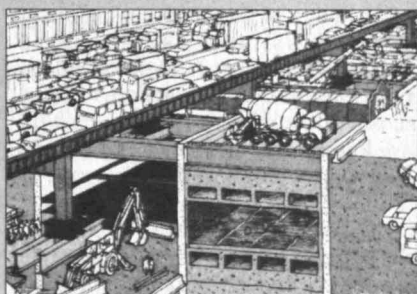
Artery, it's easy to imagine a legislator emerging from a briefing session with him pumped up and totally committed.

Winning community support was another matter. Salvucci became—willingly—the man the public would regard as personally responsible for whatever they loved or hated about the Project. At various times during the planning and review phases, East Boston, Charlestown, Beacon Hill, Cambridge, and various transporta-

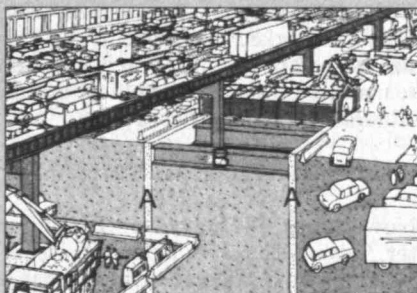
BUILDING A TUNNEL UNDER A ROAD IN USE



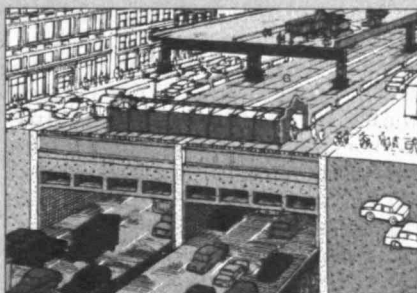
1 THE EXISTING ELEVATED HIGHWAY AND SURFACE ROADS WILL CONTINUE TO CARRY TRAFFIC DURING CONSTRUCTION OF BOSTON'S NEW CENTRAL ARTERY TUNNEL. (VEHICLES THAT SEEM TO BE FLOATING INDICATE THAT WORK IS IN PROGRESS BENEATH THE STREETS.)



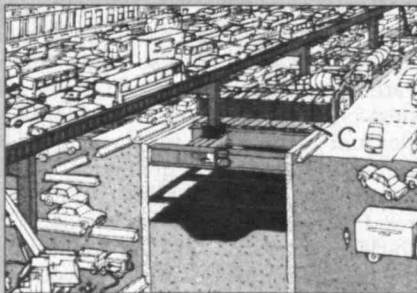
4 WITH THE DIRT REMOVED, WORK PROCEEDS ON THE ROADBED AND THE WALLS, CEILING, AND SUPPORT SYSTEMS OF THE TUNNEL.



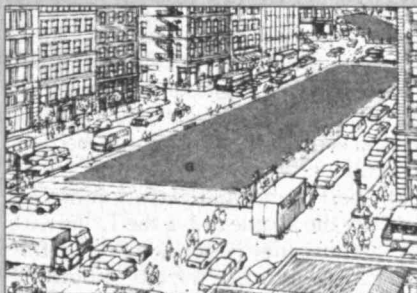
2 REINFORCED CONCRETE "SLURRY" WALLS (A), WILL BE POURED, 80 FEET DEEP, AND BEAMS (B) ERECTED BETWEEN THE WALLS TO SUPPORT THE OLD ELEVATED ARTERY. THE COVERED WALKWAY SHELTERS PEDESTRIANS DURING CONSTRUCTION.



5 WHEN THE COMPLETED ARTERY TUNNEL IS CARRYING ALL THE TRAFFIC, WORK WILL BEGIN ON DISMANTLING THE ELEVATED STRUCTURE, THUS FREEING AN ESTIMATED 30 ACRES OF LAND.



3 DECKING (C) IS PLACED OVER THE BEAMS TO SUPPORT SURFACE TRAFFIC, WHILE EARTH IS EXCAVATED BETWEEN THE WALLS TO FORM A TUNNEL.



6 NEW CITY STREETS WILL CONNECT NORTH AND SOUTH STATIONS; CROSS STREETS CUT OFF BY THE ELEVATED ARTERY WILL BE REJOINED; LOW-RISE DEVELOPMENT AND PARKS WILL REPLACE THE PREVIOUS EYESORE.



tion and environmental advocacy groups have been up in arms. In some instances, Salvucci has been able to bring people around to his point of view; in others, he made changes. But on Scheme Z, his solution for a Charles River crossing into Charlestown/Cambridge, he is still described by adversaries like Alice Wolf as having been "totally intractable." Wolf believes that looming end-of-term deadlines made him blind to possible alternatives to his fundamental design, one of which was recently adopted by the current administration.

But almost everyone who has seen him in action at any of the 1,000-plus hours of public meetings say that he's distinguished himself by being able to hold up his side in even the most heated debates with worried citizens without ever stooping to the kind of "we know best" arrogance that's often the last resort of challenged bureaucrats.

Years of such persuasion, Salvucci believes, finally resulted in widespread public support for the Artery Project. He credits his success to the hard work of his staff and the fact that he never forgot his own rage over the treatment of community groups when he was fighting the inner-city highway extensions. "You have to remember that you're working for the public," he says. "You need to find win-win solutions to problems by listening to people long enough to figure out what their most important priorities are. You listen to find potential cooperation among groups rather than competition. And then you try to put something together so that the most groups achieve their top priorities and everyone feels that they're better off than when they started."

That's Salvucci's "Jack Sprat" philosophy. Jack Sprat, you'll remember, is the nursery rhyme character who could eat no fat. His wife could eat no lean. "So they got along great," says Salvucci. "The typical way of thinking about things is that only people who agree with each other should be allies. But I've always been fascinated with people who get along *because they disagree* about what they like. The way I've tried to approach the whole transportation question is that we built this odd-bedfellows coalition.

"The best friends of the trucker on the Artery are the people riding the T," he reasons, "because they're not clogging up the road. People living in the city shouldn't have to live with an ugly highway, but they need a strong local economy to provide jobs and services. Boston is still generally successful as a city because it's still vital to the region, but the whole region's economy depends on access to Boston,

across Boston, and through Boston to the airport: these are trips that require trucks and sometimes cars, so you have to have highways. And the best friends of the T commuters who like living in the green environment of the suburbs are the people who use the transportation system to encourage development downtown and not in the suburbs."

Once Dukakis announced he would not run for reelection, Salvucci scrambled to make sure that most of the Artery/Tunnel Project was ready to go into construction. When the state's secretary for environmental affairs gave his OK to the Project's final environmental report during Dukakis's last days in office, Salvucci became the target of accusations that he had steamrolled the process. "I absolutely did that," he agrees, but he makes no apology. "There is rarely if ever any recognition that delay of good things has a serious environmental cost," he says. Dukakis himself, now on the faculty at Northeastern University, notes an important consideration: there was no fundamental disagreement between his administration and the governor-elect over the Artery. "Weld was strongly committed to the Project. With the exception of Scheme Z, there was very broad consensus, which Fred had worked to achieve. We thought we had a responsibility to carry it forward to make it as easy as possible for the new administration," Dukakis says.

Injecting Reality Into the Classroom

Now back at MIT's Transportation Center, Salvucci has two primary research projects: designing the transportation department for Buenos Aires and reviewing transportation planning in metropolitan regions with populations of a million or more for the U.S. Department of Transportation.

There's something of the kid with a new box of toys in Salvucci's voice as he talks about his research, but also an unshielded earnestness that's not common among academics, an apparent need to feel that he's not just going along for the ride. "The transportation system in Buenos Aires is similar enough to what I'm used to that I feel I have something to contribute. With the U.S. project, the most important issues we're looking at are: one, how do you integrate the Clean Air Act into a transportation system and, two, how do you reconcile enforcement of promises made in Environmental Impact Statements for long-term projects with the idea that a new, democratically elected administra-

tion should be able to make its own policies? I had to deal with both of those issues with the Artery Project, so I think I can contribute something there.

"I live within six blocks of where I was born," he muses. "I love Boston, but I'm very parochial as a consequence. So to be looking at Buenos Aires—which is just like Italy: beautiful women, great food, horrible drivers—and Chicago and Pittsburgh is just fun, it's terrific. The other nice thing about MIT is that you can bring those research experiences back into the classroom."

Injecting a measure of reality into the classroom, whether from his new studies or from his experience in Massachusetts, is one of Salvucci's greatest strengths as a teacher. During a discussion about transportation financing, he asks graduate students to think about possible benefits and costs of imposing a gasoline or other tax on drivers. The list of benefits grows long: to discourage driving and encourage use of mass transit, to encourage conservation of resources, to make drivers realize that driving isn't "free" but imposes pollution and other burdens, etc., etc. Eventually, Salvucci breaks in: "What else? What else? You guys have been listening to economists for too long. The big answer is that taxes are to raise money. I don't mean to suggest that equity issues aren't important, but the test is whether the public believes it. You know, you don't really please people by raising taxes—there aren't enough Calvinists around."

Parts of the old elevated highways are down already in Charlestown's City Square. A mammoth dredging rig has begun digging the trench for the new airport tunnel. And downtown, work has begun on the rerouting of utility lines to make room for the Artery tunnel. No one will really know whether Salvucci was right all along about the Artery Project until it's completed in another 10 or 15 years, and some urban planners speculate that only hindsight—50 years down the road—will show if it was the best choice for the city and the region.

Salvucci, though, is as positive as he was 20 years ago, back when most people thought he was nuts to commit his energies to such a far-fetched scheme. "I guess I'm stubborn," he says. "It probably has something to do with generations of my ancestors banging rocks and making things grow from soil that God didn't intend to make grow. You know, the word for "work" in Italian is *lavoro*. But in Southern Italian, it's *fatiga*. "You've got to keep at it." □



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Zen and the Art of Selling

Twenty-eight years ago I was an MIT freshman, and I wish someone had sold me then what I plan to sell you now—the idea that selling is an art to practice no matter what your calling. After decades of painful on-the-job sales training, I am sad to find that the MIT culture, at all levels, is still permeated with the notion that professional salespeople are properly placed in the food chain just below green slime.

That attitude relegates too many MIT students to bleak Saturday nights alone, because they think it unseemly to do the bit of selling conducive to lining up a date. But there are also serious professional and institutional effects as well as personal ones: Too many MIT professors are marginalized and their ideas ignored, not in technical journals or academies of science, but where they are most needed, in the corridors of power. Too many MIT administrators, paralyzed by false notions of academic dignity, fail to put MIT's best feet aggressively forward to win the Ivy-League endowments that MIT deserves. And too many MIT entrepreneurs launch companies that give no thought to selling and so promptly crash and burn.

I can tell you firsthand that selling is one of the highest arts in entrepreneurship. Most companies, even successful high-tech companies in Silicon Valley, spend 10 times more on selling than on engineering. And if it's proof you need, then read "How to Succeed in Business: an Interview with Edward B. Roberts," in the February/March 1992 *Technology Review*. Roberts shows the strong correlation between the success of start-ups and the marketing orientation—sales consciousness—of their founders.

In short, nothing happens until something gets sold.

So now let me tell you about a fantasy of mine to which I think MIT grads will relate.

A Better Mousetrap

It began with my attending a meeting about better ways to catch mice. The meeting opened with a superficial discussion of

BY ROBERT M. METCALFE '68

*Most of
our reluctance
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will be told
"NO."*

mousetraps, to which I perfunctorily listened. Having settled on one of several ideas that occurred to me during the discussion, I spoke.

The meeting fell silent as I sketched my concept for a better mousetrap and then sat back. A moment of suspense passed, and then the meeting came alive with enumerations of the many advantages of the mousetrap I had proposed—all in what seemed to me like slow motion. As enthusiasm built, and after only my occasional corrective interjection, a consensus formed around what was thereafter referred to, on every occasion, as "Bob's mousetrap idea."

For years after the meeting, my long, contemplative weekends were too often interrupted by ceremonies in which I graciously accepted prestigious awards for my mousetrap idea and its many derivatives, all of which, no matter how remote, were scrupulously traced back and credited to me. I was invited to posh parties by the most hip and happening mouse exterminators and was approached often with outrageous propositions by beautiful strangers.

Among the many checks I received spontaneously in the mail, I cashed only those from companies whose commercial

applications of my mousetrap ideas were socially responsible, environmentally sensitive, and politically correct. My fantastic wealth grew, and all but the modest fraction required to support my ascetic existence in various hideaways around the world went to support the selfless teachers and researchers at MIT's Robert Metcalfe Laboratory for Mousetrap Technology.

Selling Consciousness

I have been waking up from this fantasy for 28 years. In reality, inventors who believe that better mousetraps automatically bring the world to their doors are in the lowest of the four states of selling consciousness—the unappreciated state—and they are probably alone in the bushes.

I moved up to the next higher state of selling consciousness when I ventured out to hit people over the head with facts they were too lazy or stupid to find out for themselves—that they should have been beating a path to my door, buying my mousetraps. In this state of consciousness—the argumentative state—I told people to buy my mousetraps. They argued with me, I snickered at their ignorance, and I expected that my clever and decisive counter-arguments would force them to buy. This occasionally worked, but only up to an unsatisfying point.

In our free market system, of course, people are not compelled, even by overbearing cleverness, to buy a better mousetrap. And so, with experience and a desire to succeed, I moved up to the third state of selling consciousness—suffering fools gladly. I quietly listened to concerns about buying my mousetraps and was careful not to call them stupid. I explained in single-syllable words why my mousetraps were superior. I found that people respond positively to politeness and simplicity. Increased sales resulted.

I have observed, however, that people stuck in the fool-suffering state of selling consciousness are twisted by their own insincerity and soon stoop to the kind of over-selling and under-delivery that has given sales its poor reputation. What ulti-



*"Selling is
a high calling,
and I learned
to revel in the
subtleties of
its practice."*

mately separates the sheep from the goats in this field is understanding that prospective buyers of mousetraps are not fools. I learned that they are in fact experts—in knowing what they need. When they did not buy my mousetraps, it was either because they didn't need them or because I failed to sell them competently.

Now in this fourth and highest state of selling consciousness, I learned to listen to prospective buyers to find the maximum overlap between their mice elimination needs and the mousetraps I had to offer. I worked hard to understand my buyer. I learned to communicate the benefits of my mousetraps, first establishing my credibility and always keeping in mind that it is not mousetraps that buyers need, but fewer mice.

I learned to ask buyers for their orders, to listen for their objections, to handle objections creatively, and to ask for their orders again... and again. I delivered my mousetraps when needed and ensured that buyers were satisfied.

This was selling as a high calling, and I learned to revel in the subtleties of its practice.

Selling versus Engineering

Let me flash a few numbers by you about the relative importance of selling and engineering. Let's say a buyer spends \$181 on a Metcalfe Mousetrap. Right off the top, \$81 goes to distribution—the outside people responsible for locally selling and delivering our product. Believe me, they earn it.

Of the \$100 left after distribution, about \$50 goes to manufacture the mousetraps, including \$40 to buy the parts, \$9 for overhead, and \$1 for the direct labor to actually assemble the device. Administrative expenses absorb \$5, taxes take \$7, and shareholders receive \$10 for the use of their capital.

That leaves \$18 for my company's own field sales and factory marketing activities, and, finally, a mere \$10 for what MIT teaches best, engineering. (Of course, this last \$10 is not spent strictly on engineering, but also on engineering support and management, but let's not split hairs.)

Almost all of the \$81 spent on distribution is selling, and of course the \$18 for field sales and factory marketing is selling. That pattern, spending about 10 times more on selling than on engineering, \$99 versus \$10, is true of 3Com, the \$400 million company that I founded. 3Com is not atypical of a

successful, high-tech company.

Perhaps instead of using the old math to make my point, I should use the new. The set of all potential buyers for mousetraps is usefully divided into three disjoint subsets: the set of buyers (including my mother) who will automatically buy mine, the set of all mousetrap buyers who will never buy mine (parents of my competitors and the like), and the set of mousetrap buyers who will buy mine only when competently sold.

Clearly the sizes of these sets vary both absolutely and relatively, but the third set is much larger than many MIT people think. Selling matters.

Selling Curriculum

Let's say I am successful in selling the MIT faculty on the importance of selling. What would be covered in a curriculum designed to teach it?

Certainly there would be the basics of talking—and especially, listening—to people. Students would learn that one of the nicest things they can do for a person is to ask their advice. They would be taught ways to identify prospects for mousetraps, and how to "qualify" them—to determine whether they need mousetraps and have the means to buy them.

There would be some instruction on making presentations that build credibility and translate the features of mousetraps into benefits for buyers. Students would learn—this is critical—that it is rarely the purpose of a presentation to show how smart you are.

Students would learn about spotting "buying signs," asking for orders, and techniques for handling the inevitable objections. Toward the end they would learn the difference between sales and marketing. It would be hard to cram all this into the existing four-year programs, but selling, like engineering, requires lifelong learning.

So now, while I work on getting MIT to establish the new Interdisciplinary Program in Selling, perfecting your sales skills is something that each of you has to do on your own. Start with the most intimidating part of selling—asking for the order. Most of our reluctance to sell comes from our fear that if we ask for the order, we will be told no.

If there is one trick to selling, it is getting over the fear of rejection, and I can suggest a strategy for doing it.

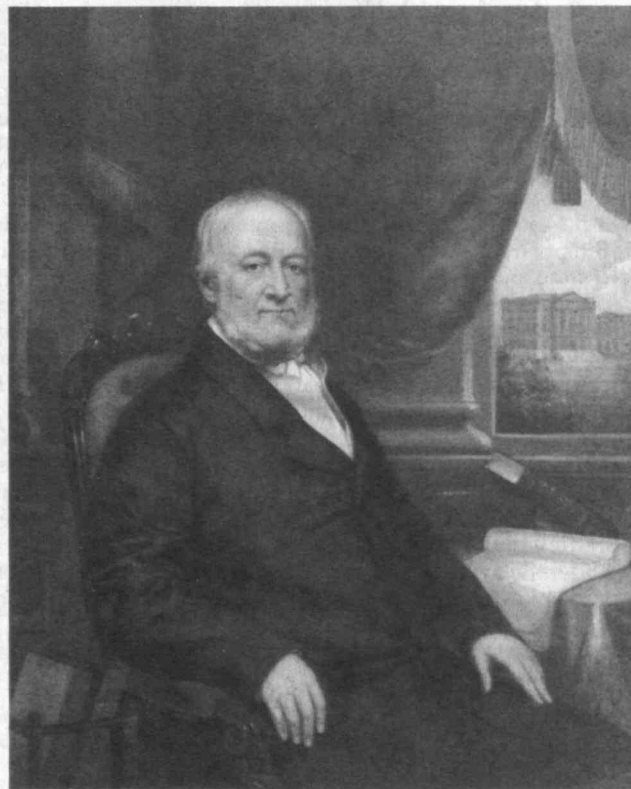
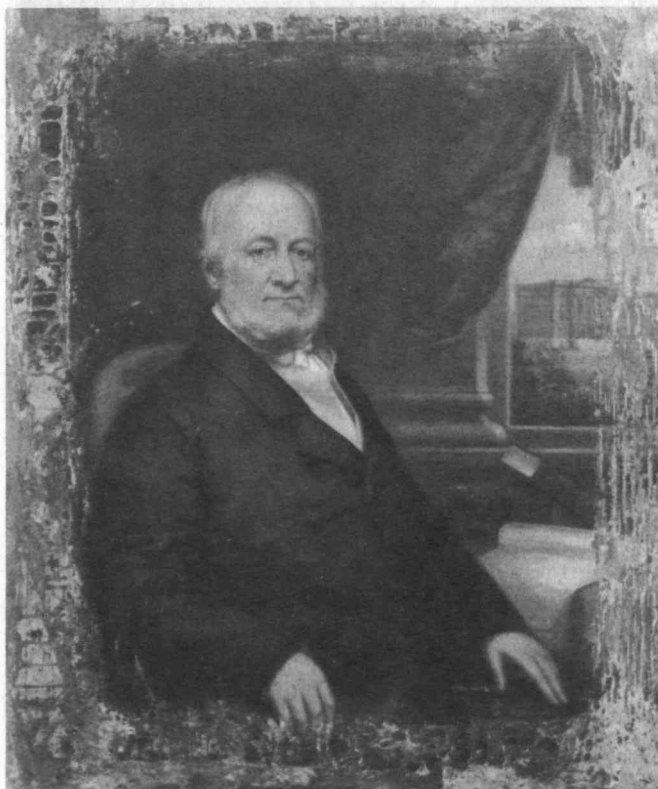
Decide that you are going to sell something today. Start with something simple, like selling the idea of going to a particular restaurant for lunch. Find a couple of people with whom you would like to have lunch and ask them to go with you to this restaurant. Then force yourself to stop talking so you can listen to the answer. If they say yes, you can move on to more challenging sales situations.

But what if your worst fears are realized, and your associates say no? This is it, the moment of truth. Smile and just ask why. Listen to the objections and try to deal with them. The way to overcome that paralyzing fear of rejection—the whole trick of selling—is to hear "no" as a learning opportunity. That's the distillation of years of learning about selling.

So, I urge you, sell something today. And if you are not convinced about why you should sell, I want to hear your objections. Or if your first few selling attempts go awry, I want to hear how. So, sell already. □

ROBERT M. METCALFE, '68, received bachelor's degrees from MIT in electrical engineering and management, and a PhD in computer science from Harvard. He invented the Ethernet local area networking system and founded 3Com Corp. in Santa Clara, Calif., to commercialize it. While finishing this year as a visiting fellow in the Computer Laboratory at the University of Cambridge, England, Metcalfe also started work as the publisher of InfoWorld. This article was developed from a lecture at the MIT Laboratory for Computer Science.

Saving MIT Then, Saving Art Now



Dr. William Johnson Walker saved MIT's charter during the Civil War, and now MIT has returned the favor, in a manner of speaking, by restoring his portrait, all but ruined by overpainting and poor handling.

Dr. Walker's portrait, the first work of art commissioned by MIT, was also the first project to receive a grant from the Council for the Arts at MIT under a new program for restoring the Institute's fine arts collection. The portrait now hangs in the Alumni/ae Center, appropriately enough, in the keeping of a branch of the Institute concerned with memories and memorabilia.

Walker, by all accounts, was one of the most eminent American surgeons of the early 19th century, and he prospered as a Boston-area businessman following his 30-year medical career. He subsequently retired to Newport, where he died in 1865 at age 77.

The story of his charter-saving gift to MIT has achieved a place in Tech legend. MIT was incorporated on April 10, 1861,

with the provision that William Barton Rogers and his colleagues raise at least \$100,000 in one year. The Civil War began a few days later, drastically reducing their chances of raising anything at all. The deadline was extended for one year, but even so, only \$40,000 had been pledged. At the eleventh hour, Rogers received word that Walker had offered 600 railroad shares worth more than \$60,000. It was not Dr. Walker's largest gift to MIT—he bequeathed approximately \$200,000—but it was the most critical.

A year after his death, the Institute commissioned Boston portraitist Henry Cheever Pratt, who painted Dr. Walker in a pose typical for the period: the subject is seated at a table in front of a curtain drawn back to reveal some relevant scene, in this case Tech's original buildings on Boylston Street in Boston. The near-photographic rendering of Dr. Walker's face reflects at once a Yankee gentleman "of a hot and hasty temper, decided in his opinions, and often harsh in manner...

More than 100 years of well-intentioned mishandling brought this portrait of Dr. William Johnson Walker, MIT's first major benefactor, to the condition at left. A grant from the Council for the Arts at MIT and a fortuitous discovery contributed to restoring the portrait to its original dignity.

shrewd in his judgments, keen in business, of a dry and pleasant wit, yet obstinate and sometimes overbearing..." as he was described in *Technology Review* in 1899.

After Tech moved to Cambridge in 1916, the Walker portrait traversed the campus for decades, surfacing in President Killian's office in 1950. The painting was restored in 1972 and has hung in various distinguished settings ever since. But a minor crack was discovered recently when the work was being considered for the President's House, according to Warren Seamans, director of the MIT Museum, and the canvas also suffered from a whitening

of the outer coat of varnish. Hired to treat those problems, Morton C. Bradley, Jr. an area restorer of fine art, discovered a lot of overpainting.

Gradually, a sad tale of well-intentioned abuse came to light. At one time, the edges of the portrait had been folded under three to four inches to fit Dr. Walker into a smaller frame. Some time later, the portrait was unfolded to fit a larger frame, but the paint at the edges was found to have flaked off almost completely. In an attempt to correct that flaw in 1950, a restorer painted in a wide, dark-brown margin that sliced off the fingers of Dr. Walker's right hand and obliterated all the other remaining border detail. When the portrait was submitted to X-ray and infrared examination at Harvard's Fogg Conservation Lab, Bradley found little of the original work under the overpainting, which was then painstakingly removed before the

canvas was sent to another conservator for further restoration.

Anyone restoring an original painting is, by definition, unlikely to have an identical work from which to work; imagine having two Sistine Chapel ceilings to compare. But fortunately for MIT, Dr. Walker also left money to both Tufts University and the Redwood Library of Newport, gifts that were commemorated with identical portraits by Pratt, differing only in the background buildings. Seamans and his counterparts at these institutions were unaware of the other portraits. But as luck would have it, Boston art restorer Peter Tyson of Oliver Brothers had completed work on the Redwood Library portrait only days before its badly damaged mate arrived from MIT.

Now that he had the Redwood model to work from, Tyson was able to restore Dr. Walker's right hand and other

details, and he brought the buildings in the background into perspective—all in all, a fine example of mid-19th century Victorian portraiture.

Both the MIT and Redwood paintings were unveiled at the annual meeting of the Council for the Arts at MIT last fall, highlighting the changing focus of the council's Acquisitions Committee to increase funding for conservation of MIT's collections. "For the last few years, it's been difficult to acquire [new work] of value, since the cost of important artwork has exploded," said Mark Palmgren, director of the council. As the number of major acquisitions decreases, the resources available for restoration are increasing, Palmgren explained. □

—Robert Dimmick

The author is the administrative assistant to the executive vice-president of the Alumni/ae Association and a free-lance writer.

BASED ON MY
EXPERIENCE, I WOULD DEFINITELY
ENCOURAGE MIT ALUMNI TO GET
INVOLVED WITH PRONET... SINCE I
JOINED THE SERVICE I'VE HEARD
ABOUT SOME TERRIFIC OPPORTUNITIES,
AND I PLAN TO USE PRONET AS A
RESOURCE THROUGHOUT MY CAREER.
I'M GLAD MIT OFFERS THIS
PROGRAM TO ITS GRADUATES.
MICHAEL B. PARKER '89

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CLASS NOTES

15

It is always a delight to extend greetings to all MIT alumni/ae and the Institute! The Class Supreme, 1915, has been a very devoted gang, showing great interest in and gratitude to their own class and the college itself.

At age 98, **John Homan** passed away in Indian Rocks Beach, Fla., last August. He had been in good health since his retirement from United Shoe Machinery Corp. in Boston. He was born and lived in Swampscott, Mass., until moving to Florida in 1957. He was interested in town affairs and served as park commissioner for many years. An avid golfer and yachtsman, he continued those sports throughout his retirement. He was a member of the MIT Alumni/ae Association and the Theta Xi Fraternity.

John is survived by a son, William Homan of White Plains, N.Y.; a daughter, Leonore Weitlauf of Largo, Fla.; three grandchildren, William Weitlauf of Largo, John Homan of Marblehead, Mass., and Christopher Homan of Peabody, Mass.; and eight great-grandchildren. He was the father of the late John Homan, who was killed in World War II, and the late Frank Homan, formerly of Marblehead. We received all this information from John's daughter.

Bob Warren and yours truly called John the day after our 70th Reunion. He was delighted to receive tidings from 1915 and said that he had just returned from England and that if he had known we were going to be at MIT for the gathering, he sure would have made it.

Back in October 1991, I received the following note from Heather Huber, '89: "I just read the section in the October issue of *Technology Review* about Technology Day and alumni/ae gifts. I am so impressed and thankful for the enormous contributions from the 'Cardinal and Gray' classes. The continued dedication and devotion to MIT is wonderful and inspiring. I love the idea of the Cardinal and Gray tradition and hope that I will be a part of the club 48 years hence. May our present classes vow to continue the tradition and the gifts to MIT. Thanks again. You all are terrific."

Perhaps we can conclude from that letter that even though 1915 has faded, there are many more classes to carry on and hopefully follow the example set by the Class of 1915—their loyalty to one another and all the alumni/ae, their generosity, their faithfulness, their kindness, and especially their *spirit*! Every "fifteener" would love to see MIT continue to be the wonderful college it has always been!

My love and devotion to each and every class! And farewell: **Joyce E. Brado**, acting secretary, 491 Davison Rd., Apt. 9, Lockport, NY 14094

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All of you were mailed greetings and good wishes for the year 1992 last December. I am happy to include your replies herewith.

Arthur Williams writes as follows: "Most of my time is spent trying to get well after my stroke in February 1989. Am pretty good except for weakness in legs. Sometimes fall—so far, no injury. I think I will get used to it. I was '77' again in August for the third time—staying young in the 70s—it works."

Eli Berman's letter includes exciting news from him. "Christina and I are spending the winter here on the island of Coronado off the coast of southern

California. The weather is delightful. We plan to be back in Chestnut Hill late in March to attend the wedding of Christina's granddaughter, Jodi."

Paul McGreener, a fellow townsman, called me on the phone. He is 96 years old and now a resident at Briarwood Nursing Home in Needham. He reports doing well for his age.

Giles Hulseman sends his greetings from Tucson, Ariz. He is in excellent health—no pills. . . . A most cordial New Year's greeting came from loyal **Herb Lamer**.

I record with sorrow the news that **Stuart Caldwell** passed away on November 26, 1991. Lorraine, his better half for so many years, included the sad news in a most friendly letter.

Bill Jones' letter included, in addition to his seasonal greetings, his belief he may be the last '18 man to receive degrees from both MIT and Harvard. . . . Other friends of the MIT family who sent good wishes for 1992 include Ann and Ken Brock, Marvin Pickett, Conchita Pearson, and Diane and Jim Bidigare.—**Max Seltzer**, secretary, 865 Central Ave., Needham, MA 02192

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In a recent class notes we offered to send the special class of 1919 book, *25 Years After*, to any member of our class who might be interested. The book was prepared by a Publication Committee, chaired by **Gene Smoley** and nine other classmates, three of whom are **Leo Kelley**, **Don Way**, and your class secretary.

We received a request from Mr. John A. Maynard whose father **Warren Maynard** was a member of our class. We sent him a book and he read it from cover to cover and enjoyed it very much. He commented that in "addition to the bio page, his father appeared in two group pictures and was mentioned in the Reunion writeup." He thinks the committee who put the book together did a fantastic job. If some other classmate would like a copy, just drop me a line.

My mail contained another letter from **George Michelson** thanking us for the good wishes we sent to him. He received a letter from **Leo Kelley** wishing seasons greetings which brought him many old thoughts and emphasized the span of years.

We will be pleased to receive any words from you so I can keep these notes alive.—**W.O. Langille**, secretary, P.O. Box 144, Gladstone, NJ 07934, (908) 234-0690

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Please send news for this column to: **Harold Bugbee**, secretary, 313 Country Club Heights, Woburn, MA 01801

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Class officers for 1921 are: **Carole "Cac" Clarke**, president and class agent; **Sumner Hayward**, secretary and treasurer; and **Samuel Lunden**, assistant secretary.

In last month's issue of class notes, we reported the death of **Irving Jakobson**, one of the stalwarts of our class. He was captain of the crew in his undergraduate days and years later at one of our five year reunions, he presented a shell to MIT at

the Technology Day luncheon. Jake was owner of the Jakobson Shipyard in Oyster Bay, N.Y. The shipyard built a submarine cable laying boat for the New York Telephone Co. and your secretary remembers taking a ride on this boat around New York Harbor.

Two other deaths are reported this month: **Thomas B. Davis** of Memphis, Tenn., on September 20, 1991; and **Warren K. Brimblecom** of South Yarmouth, Mass., on December 18, 1991. Brimblecom was a Newton state representative from 1932 to 1940 and was publisher of the *Newton Graphic* newspaper from 1924 to 1941. He sold the newspaper in 1941 and became a purchasing expeditor for Stone & Webster from 1941 to 1964. He retired in 1970.—**Sumner Hayward**, secretary/treasurer, Wellspring House E64, Washington Ave. Ext., Albany, NY 12203; **Samuel Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

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70th Reunion

Please send news for this column to: **Martha Munzer**, acting secretary, 4411 Tradewinds Ave. E., Lauderdale-by-the-Sea, FL 33308

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Please send news for this column to: **Frederick O.A. Almquist**, secretary, 19 Griswold Rd., Wethersfield, CT 06109

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Please send news for this column to: Co-secretaries: **Katty Hereford**, Box 5297, Carmel, CA 93921; **Col. I. Henry Stern**, 2840 S. Ocean, #514, Palm Beach, FL 33480

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Your classmates seem to be reluctant to write to the class secretary. Thus, I am forced to write about a few of *my* activities here on the elbow of Cape Cod. I still play golf if the weather is favorable and I join a group of retirees once a week, September through May, for a morning of bowling. Unfortunately, I find that as my golf score increases my bowling score decreases. Our retired men's club meets weekly October through May. A social hour with coffee and doughnuts is followed by a speaker and a short sing-along. My fingers have remained flexible enough to provide piano accompaniment.

On a solemn note, we report the passing of **Robert B. Hatton** on November 26, 1991. He lived in Andover, Mass., and worked for many years at Champion International Paper Co., Lawrence, where he was in charge of making the coating for the paper used by *National Geographic*. He was associated with the Boy Scouts of America for more than 70 years and served as scoutmaster of several troops. An avid hiker, he and his family camped in the mountains throughout New England. He helped found the Pequaket Mountain Club. Bob is survived by his wife, Virginia Hatton, a son and a daughter, as well as two stepsons.—**F. Leroy (Doc) Foster**, secretary, 434 Old Corners Rd., P.O. Box 331, North Chatham, MA 02650

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Richard H. Pough of Pelham, N.Y., writes that he is still going strong after a new hip and two new knees. One of the organizations he helped to found, The Nature Conservancy, has had a hand in protecting six million acres of land in the United States and has sparked similar programs in other countries. He now spends half the year in New York and half in Martha's Vineyard.

Thanks to Samuel R. Spiker, '25, for notifying me about the death of **Alfred Willard French**, who died January 8, 1992. Al, formerly of Piqua, Ohio, and more recently of Naples, Fla., was president of several campus organizations at MIT, including Phi Beta Epsilon, and was Sustaining Fellow, Permanent Member. He joined his father's company, French Oil Mill Machinery Co. upon graduation from MIT, and by the 1950s it had become the leading manufacturer of screw press technology in the world. By the time he retired in 1983 he had 22 U.S. patents to his credit and had expanded the company to serve customers in 65 countries. He had recently celebrated his 65th service anniversary, and continued as chairman of the board of his company until his death. French had major involvement and support roles in a number of activities, including the Miami County YMCA, Rotary International, the Piqua Country Club, St. James Episcopal Church, the Racquet Club of Piqua, the Park Board of the City of Piqua, the Piqua National Bank and Trust Company, the Grier School for Girls, the American Defense Preparedness Association, many trade associations, the Royal Poinciana Golf Club, the Naples Yacht Club, the Ox-5 Club (for pilots who flew planes powered by that pioneering engine), the Metropolitan Opera Association, the Naples Philharmonic Center for the Arts, plus many others. He is survived by two sons, a daughter, a sister, nine grandchildren, and two great-granddaughters.

Clinton B. Galphin, of Raleigh, N.C., writes about his years after graduation from MIT: He worked with an engineering firm that designed textile mills, tobacco factories, and paper mills (1926-1938), after which he worked about 11 years with an electrical contractor as an engineer on power lines and substations with some time spent as engineer and plant manager of a manufacturing plant for a defense contract during World War II. Later he worked as a consulting engineer for 25 years with projects that included water treatment plants, industrial plants, air conditioning systems for hospitals, art museums, football stadiums, electrical transmission systems, roads, and bridges. He served for 12 years on the North Carolina Building Code Council. Clinton plans to celebrate his 65th wedding anniversary next year. He has one daughter, two grandchildren, and one great-grandson. Clinton sent along a copy of a booklet he wrote, containing jokes, cartoons, and funny stories under the title *The One I Forgot To Tell You*.

Your class secretary has continued to improve, and feels better than the medical personnel seem to think. I'm still getting around with a walker (though I think I don't really need it) and have been getting out and around to some less strenuous activities. I recently published a short, four-page biography, and suggest all '26 members should think about doing the same.

Keep sending your letters to me so I'll have something to report.—**Donald S. Cunningham**, secretary, Eventide, 215 Adams St., Quincy, MA 02169, (617) 328-1840

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65th Reunion

Laurence W. Day reports the outcome of the operation on his knees mentioned last month. "Results are good. I am walking with a cane and am now knock-kneed instead of bow-legged. The operation January 3rd was painful and the recovery is not easy, but it was fast after only 11 days in the Yale New Haven Hospital. Replacing both knees at one time seems wise. After two weeks intermediate

care, returned to our apartment January 27th after quite an experience. The doctor says I'll be back in the garden by spring. Perhaps we can play tennis at our 65th in June!" Congratulations Larry and thanks for your report. I'll bring my racket.

Walter E. Caunt of South Yarmouth, Mass., has sent a brief summary of his life which I am glad to report and retain in our files. "I spent the first part of my professional career (1927-1961) as a civil engineer and registered land surveyor with the Public Works Department of the Town of Wellesley. The second part (1962-1988) in private practice: design and supervision of construction of residential developments in Norfolk and Middlesex Counties. This I enjoyed greatly. "I am a life member of MALSCE (Mass. Assoc. of Land Surveyors and Civil Engineers), veteran member (62 years) of the Grand Masonic Lodge of Mass., life member of Mass. Consistory 32, and member of the MIT Club of Cape Cod. I have been a lay reader in the Episcopal Diocese of Massachusetts. I am now really retired and living with my wife Marion of 62 years at Thirwood Place, a posh retirement community in South Yarmouth.

"I am sorry I will not be able to attend any of the reunion festivities but will want to hear about them. I am quite badly handicapped by diabetes and acute arthritis."

David R. Knox of Lantana, Fla., died on November 25, 1991, after a brief illness. His widow, Jean, has expressed David's constant loyalty and devotion to MIT. These notes have previously reported of his active and rewarding years. Recently he composed an autobiographical booklet and set a good example for us.

After retirement Dave took up oil painting as a hobby and gave his family and friends happiness in receiving the results of his handiwork. These paintings will convey memories of him far into the future. We give our sincere sympathy to Jean and their large family.

Edward R. Coop of Rumford, R.I., died on December 15, 1991. He graduated from Brown in 1924 before graduating from MIT. In the 1940s he taught at Brown. He worked for General Electric Co. in 1928 and a year later was made distribution engineer for the electric utility system in South County. In 1937 he became a sub-station engineer for Naragansett Electric Co. Ed was district engineer in Providence for the New England Electric System Southern District until retiring in 1967.

Ed was president of the Providence section of AIEE, 1959-1960, and chairman of its committee on capacitors. He was member of the Pawcatuck Lodge of Masons, AF and AM, Conn.

At latest count we have 163 members of our Class with known addresses. Congratulations to all you fellows in your mid 80s. We hope a good number of you will attend our 65th reunion starting on June 3rd. The program has been mailed to you from president **Bud Fisher**.—**Joseph C. Burley**, secretary 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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With regret our first item is the announcement of deaths. **Robert F. Schuler** died on December 16, 1991. . . . **Kenneth Allen Clark** died of a stroke December 25, 1991. . . . And Anne Groebler Palo, wife of our Class Agent **George Palo**, passed away on December 17, 1991. We offer our sincere condolences to their relatives and friends.

News has been received from **Roland D. Earle** that he has married a long-time friend of his deceased first wife. Best wishes to them and congratulations for maintaining the youthful spirit of our Class of 1928. Roland was chairman of our 20th Reunion Committee.

A note from **Gabriel (Gabe) Disario** in Venezuela contained an interesting six-page newsletter MIT en Venezuela October 1991. Five pages in Venezuelan Spanish are about an energy symposium, but the sixth page in English, which I can read, was a fine

profile of Gabe. He will be at our 65th, his ninth in a row. Gabe and his wife Helen have a daughter Caroline, '56, who married Russell Chihoski, '56, and they in turn raised two children who became MIT graduates. With support like that how can Tech fail?

Our Class Agent **George Palo** says that contributions to the Alumni Fund were from 25 percent of our class as of December, which is about normal, but he hopes for a better than normal response to reach the June goal. The times are not conducive to generosity though needs and requests everywhere are more urgent than ever. There is still time to respond.

Preliminary plans have been made for our 65th Reunion to be held on campus June 3-5, 1993, with headquarters and accommodations at McCormick Hall. Activities will include our traditional Carlisle Party on the 3rd and attendance at Technology Day on the 4th, with other activities and rest periods considered. As I was preparing to write these notes word came from **Bettie (Chester) Day** that she has enlisted their son Chester Jr., '56, to escort her to our 65th. We welcome Bettie's interest and determination.

Our class is believed to have been the first to make wives of '28 graduates official members to join with our lady graduates who earned the right the hard (or easy?) way. Also, it should be noted that prior to our 25th Reunion wives did not attend, but at our 20th at Wianno Club on Cape Cod the change in policy was pre-ordained by the presence at a nearby hotel of **Anne (George) Palo** and **Madeline (Harold) Porter** who put in an appearance to check on those with whom their husbands were associating. Also, the change was undoubtedly assured by **Bill Carlisle** being chairman of the 25th.

As we have to think still further back into the ages to our undergraduate days it is good therapy to recall interesting or amusing events. Do you remember **Charlie Lyle's** stripped-down and stretched-out Deussenberg chassis that was usually parked on Massachusetts Avenue by Building 1, with its engine exposed by missing hood panels showing room for a spare engine and the unbelted fan turning continuously except during periods of windlessness?—**Ernest H. Knight**, secretary, Box 98, Raymond, ME 04071, (207) 655-4231

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Those who attended our 60th Reunion held on the MIT campus and who knew and saw **Neil Wells** of Florida in recent years, realized that there was something wrong with him. He hardly spoke a word. He was brought to MIT by his son who lives in Wellesley Hills accompanied by his grandson. A week ago, I got a telephone call from Neil who spoke very well, although a little haltingly; nevertheless, he carried out a good conversation. I asked him what was wrong with him at the time of the 60th. He informed me that a problem with his prostate, which was cured with surgery 30 years ago, had returned and he was under treatment at the 60th! I asked him about his son and I was shocked to learn that his son had suddenly passed away. He had fast developing multiple sclerosis, which had been in stable condition, but became active and carried him off. He was their only son, but Neil and Helen are not alone. Their grandson is doing very well in these hard times, working as a manager in an electronic business and planning to marry next June. Neil and Helen also have a loving and caring granddaughter who is a biologist working in Seattle, Wash.

My wife Helen has completely recovered from the ordeal of her auto accident a year ago. A month ago she and I attended the reception for our new president, **Charles Vest**, given jointly by MIT Clubs of West Palm Beach, Fort Lauderdale, and Miami. We were guests of our friend of 65 years, **Robert S. Pride** of North Palm Beach and his wife **Marian**. We have kept class relationship with the **Prides** from Somerville (Mass.) High School days and MIT to this date. They are proud to have a married

daughter, and they have a goodly number of grandchildren and five great-grandchildren, two of whom are identical twin girls.

A note from **Bill Bowie** and wife **Sally**, of Olmstedville, N.Y., says: "I had my second cataract surgery October 30, which is coming along fine. However, I find that I do not have my usual pep and endurance. We gave up our apartment in Albany at the end of September and moved everything up here. As a consequence we are bulging at the seams—too many chairs, pictures, kitchen utensils, etc. Gradually, we are finding people who can use some things for a while and return them to our household later. We are planning a quiet Christmas here. Doubt we will make it south next spring."

Butler King Couper of Tryon, N.C., sent his season's greetings. He writes: "A pacemaker keeps me going at 86 (next week) but it does not open any garage doors yet." ... We also heard from **Dick Piez** of San Mateo, Calif.

Recently, the MIT Corporation bestowed upon your class secretary, **Karnig S. Dinjian**, and his wife life membership as Sustaining Fellows of MIT, which we consider a great honor. We will cherish it the rest of our lives.

I regret to announce the death of **Milton M. Clapp** of Edgecomb, Maine, on December 1, 1991.—**Karnig S. Dinjian**, secretary, P.O. Box 83, Arlington, MA 02174, (617) 643-8364, (407) 395-2890

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As previously reported, **Morris Shaffer** retired in 1985 from his post at the LSU School of Medicine. However he still has office space there. The nature of his work is "largely Brownian movement: random motion, without translation." Moe and his wife, Margaret, do considerable traveling and have friends and former students in many lands. He keeps in touch with **Milton Mezzoff**, who lives in Providence, R.I., by phone and correspondence, and has visited **Sol Uman** in Florida. ... Class President **Ed Pritchard** reports from Wetamoe, Mass., that Cape Cod has a very active MIT Club at which he sees **Al Burling** and **Dick Foster** from time to time. The Pritchards have a married daughter, Jane, who lives in London. The elder of Jane's two sons, attends Kings, Canterbury, the oldest boarding school in England, founded in the 6th century! The Pritchards' son, David, is an MIT physics professor who also has two sons, the elder of whom is a junior at MIT.

It is again necessary to report the loss of more of our classmates: **Henry Addison** on October 10, 1991, and **Willard Selden** on November 29. Henry was a longtime resident of Northampton, Mass. He worked as a chemist at Pro-Brush for 28 years and held several patents on nylon brush bristles. He later moved to Chartpak Corp., from which he retired in 1970. Henry served more than 25 years on various Boy Scout councils and was awarded the coveted Silver Beaver, a national award for outstanding service to scouting. He was a member of the American Chemical Society, the National Association of Watch and Clock Collectors, and Alpha Chi Sigma, the honorary chemical fraternity. He is survived by his wife, Louise, two sons, two daughters, seven grand-children, and four great grandchildren.

Bill Selden started at MIT with the Class of 1927, stayed out for a while to earn the money to continue, and finished with our class in Course XV-2. He spent much of his working career in government service, including 17 years in quality assurance engineering work at the Springfield, Mass., Armory. When the Armory closed in 1968, he moved to Westover AFB, where he served as a civil engineer in charge of pavement design until his retirement in 1972. After his retirement, he spent his time on church-related activities and rescue mission work. He was a founder in 1951 of the Springfield Rescue Mission, an organization devoted to "rescuing skid-row types, many of whom have been restored to fruitful Christian lives." Bill is survived by his wife, Esther, two

daughters, **Barbara Rayder** of Longmeadow and **Martha Mazzaferro** of Ludlow; ten grandchildren; and seven great-grandchildren.—**Gordon K. Lister**, secretary, 294-B Heritage Village, Southbury, CT 06488

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Please send news for this column to: **Wyman P. Boynton**, secretary, 668 Middle St., Portsmouth, NH 03801



**Tom Weston, '32
Reunion Chairman**

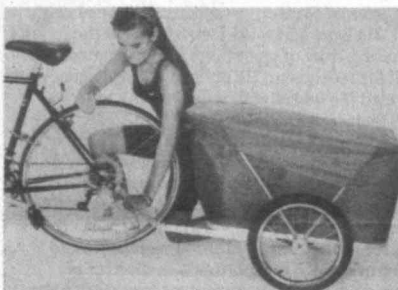
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60th Reunion

F.R. Morral is one of our most professionally active classmates. In 60 years he left indelible footprints in many fields—metallurgy, electrochemistry, corrosion, x-ray diffraction. He has traveled all over the world, gave 450 technical lectures in English and Spanish, published over 200 articles, and authored a general metallurgy book in Spanish. For some years he was known as "Mr. S-Curve Morral" and later as "Mr. Cobalt." In 1971, the Columbus Technical Council awarded him the title of Technical Man of the Year.

In 1928, MIT's dean predicted ten job offers to each graduate. He was wrong. So in 1932, F.R. hitch-hiked and rode freights to Los Angeles for the Olympics. One of the disappointments in his life is that he never saw the Olympics. In 1934, he married Lillie Westberg. They have five children and eight grandchildren. Including spouses, the family includes five PhDs, three MAs, one MD, and one JD. F.R., at 85, does not think he will be able to make the 60th. Among other things he has hearing problems. Hearing too many voices makes him dizzy. He sends his best wishes to all his classmates for a good reunion.

Russ Robinson writes that he plans to attend the 60th Reunion. He would like our class of 1932 to have some distinguishing dress—perhaps a snappy purple jacket, or an emblazoned white scarf, or something. We'll consider this at the next committee meeting in March. Russ retired in 1971. After 20 years of retirement, his brain and body needed some real exercise. So at the age of 80, in April 1991, he started a new enterprise. He designed, and now manufactures and markets a foldable cycle trailer. It attaches easily to a bicycle



and carries cargo. No need for a second car. Good for a recession period, which Russ expects will last quite a while.

I received a very nice letter from Doris Gilman. She wants to participate in "Project 2000" and make a contribution in Don's memory. (Donald Gilman was our first class president.) It would give Doris great pleasure to know that Don's name was somewhere in print in the school that did so much for them both.

Doris writes, "It was ten years after our marriage in 1934 that we celebrated by mailing the final check to pay for 'our' education. When Don died in 1987, I received a letter from a later MIT graduate telling me that when Don paid his debt to the Quincy Rotary Club loan scholarship, he, Paul Block, received the money so he could go to MIT. It was very heartening." We do hope to see you at the 60th Reunion in June.

Robert B. Follansbee writes the following to us. "Sue and I spend our winters in Venice, Fla. We very much enjoy the monthly meetings of the MIT Club of Southwest Florida, where we often see classmates **Kip Adams**, **Phil Benjamin**, and **Henry Mitchell**. We were sorry to learn that our "gal" classmate **Kay Sarabia Burrows** will no longer be wintering in Florida."

Raymond K. Flege writes us that he retired in 1972 from the Georgia Tech faculty. He is sorry he cannot be at the 60th with us. He tells us that **Halsted R. Warrick** passed on in August 1991, in Henderson, N.C.

We have received the sad news that **Richard Andrew Lobban** came to the end of his 84 years. Trained as an electrical engineer, he worked for most of his professional life as an executive of the Picker X-Ray Corp. Every year of his life he was in his beloved Bridgewater, N.H., where the family has been going for six generations. Love of stamp collecting, golf, fishing, alumni affairs, and a devotion to Scottish culture and history were always with him. He leaves his wife, Dorothy, two daughters, a son, seven grandchildren, and one great-grandson.

We learn also that **Max Katz** died in a hospice in Boca Raton, Fla., at the age of 85. In 1956, Mr. Katz and a partner founded the New England Serum Co. in Topsfield, Mass. He retired in the late 1980s. He leaves his wife, Rose, two sons, a daughter, and five grandchildren.—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Sorry, but aside from the small item immediately below, we have no good news of any classmates. **Joel Stevens** reports from Kingsport, Tenn., that he and Elizabeth are relatively healthy and see Arlene Regan and Olive Smith frequently.

Joel's note included notice of the death of **Raymond Smith**, 1521 Fairidge Dr., Kingsport, Tenn. He retired from AFG in 1974 as director of engineering and international licensing at corporate headquarters. Mrs. Smith may be reached at home.

Bill (William E.) Rohman, 43 Fairlee Rd., Naples, Fla., passed away November 25. He had been a flight engineer with Lockheed in Burbank and in engineering capacities at United Technologies, worked actively on the Apollo space program, and with the Mended Hearts Association. He was an active member of St. Peter Claver Church.

Warren S. Daniels passed away December 31, 1991. He worked for the Department of the Interior, including chief of operations in Washington, D.C. until his retirement. He opened a travel agency and traveled the world with wife Dorothy who is at 7208 Statecrest Dr., Annandale, VA 22003.

Jack Frost Andrews passed away December 29. He was one of the very few members of our class whom I still knew as a friend; I have made a contribution in our name to the Bowman's Hill Wildflower Preserve in Washington Crossing, Pa. Jack retired in 1981 from the New Jersey State Department of Transportation as director of planning and environmental analysis. Prior jobs

included editor for McGraw-Hill and responsibility for Eagle Pencil, Tite Flex, and General Cable. Jermain can be reached at 11 Hendrickson Rd., Lawrenceville, NJ 08648.

Frank Gilmore died January 1, 1992, at age 80. After graduation and a master's in business in public administration, he taught at Harvard Business School, Washington University in St. Louis, Mo., and Cornell, where he became professor emeritus of that Graduate School of Business and Public Administration. He also directed Cornell's Executive Development Program. He was president of the MIT Club from 1978-80 and active at St. Mary's Episcopal Church in Barnstable, Mass. His widow, Mary Lee, lives at 2302 Cortez Ave., Vero Beach, FL 32960.

Just received notice that **Walter Brownell** died September 1, last. His family may be reached at P.O. Drawer 1625, Clanton, AL 35045.

I lied about having no news. **Roger Congdon** lives at Givens Estates, 15-B Wesley Dr., Asheville, NC 28803. He inquires about **Put Putnam**, who had been phoning Roger until late last year. Should anyone have information, please communicate it to Roger.

The inevitable actuarial phenomena effect on our class along with all others leaves a dwindling number of members. Those of you who are active enough intellectually and can still write would be doing a favor to your classmates, including your secretary, if you were to take pen or word processor in hand and share your life's more interesting experiences with us.—**William B. Klee**, secretary, Box 7725, Hilton Head Island, SC 29938

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John Hrones writes that **Neal Karr** informed him of the death of **Frank Milliken** on December 4 in Arizona after a long illness. Frank and Barbara had lived in Darien, Conn., for some 40 years before moving to Arizona this past year to be near their sons, David and Frank. John called Barbara, and they had a good time reminiscing about the 1930-34 period.

John says: "Barbara was at all hockey games to cheer Frank and the rest on. Frank was captain of the team during our senior year. In particular, we recalled one bitterly cold day when **Roger Williams**, Barbara, Frank, and myself drove from Cambridge to Durham, N.H., in Frank's open roadster. One of us (Barbara claims it was her) stuck a foot in the heater and put it out of commission for the duration of the trip. We played UNH on an outdoor rink with a 25-mile wind blowing the length of the rink. Frank had a distinguished career ending up as CEO of Kennecott Copper Corp. He also served for a number of years as a member of the MIT Corporation."

John continues, "At a meeting of The MIT Club of SW Florida, I had the pleasure of introducing Dr. and Mrs. Charles Vest. Present at the meeting were Beth and **George Fowles**, Jean and **Henry Humphries**, and Jo and **Walter Read**. On October 5, 1991, I lost Peg, my devoted and loving companion for 53 years. She had been ill with Parkinson's disease for some years. I miss her very much."—**Robert Franklin**, secretary, Box 1147, Brewster, MA 02631; **George Bull**, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

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Harold "Hal" H. Everett writes from his home in Flagler Beach, Fla., that he made a combined visit to Boston Pops and Technology Day ("did not find any other member of our class") with a visit to the New England Historic Genealogical Society in Boston, where he delivered a copy of his genealogy manuscript titled *My 166 Immigrant Ancestors, 1620-1650*. He spent August and September in their cottage at Ocean Edge Resort in Brewster on Cape Cod and enjoyed several visits with **Jack Hossfeld** and Silera, who have summered in Orleans on the Cape for many years.

Dr. James W. Libby, Jr., writes from Hockessin, Del., that his monetary contribution to the Alumni/ae Fund is earmarked for the Sailing Pavilion. "Incidentally, an article about **George Owens** appeared in a recent issue of *Wooden Boat*. I had not realized that he designed an America's Cup candidate defender." He continues that the sloop he once owned with Thonet Dauphine was eventually given to the College of Marine Studies, University of Delaware. James is still sailing at every opportunity and helped replace an Atomic Four with a diesel engine a couple of winters ago in a Sabre 34.

Stanley M. Lane writes from Helena, Mont., that he is doing O.K. for a 77-year-old MIT grad. About a year ago, he appeared to be out of it. However, it was another Tech grad with exactly the same name who had died. "Fortunately, I have been resurrected and continue to enjoy life in the Big Sky Country of Montana."

Here are some highlights from the **H. William Parker** Annual Christmas Report, 1991. Bill fractured his pelvis when a six-inch sleet storm hit the Bella Vista, Ark., area a year ago. Marjorie said they resumed their walks with the help of a walker after the ice melted. In April, Bill had a successful cataract operation, but he developed a second cataract in July. The family had 10 around the table at Thanksgiving "and it was a fun family time." Bill has played some golf and is planning on painting again. Marjorie keeps busy with library, AAUW, DKG, and book club. She reports they have enjoyed a new gadget that lets them get captioning on TV and videos. Since Bill has balance problems, he does not do any driving, so she "has no errand boy." They have a lot of laughs over their problems and are fortunate to be in a caring community with many resources, including good friends.

Laurence A. (Larry) Stone writes from Arlington, Va., that he is still working full time for the Army Material Command trying to ensure that large defense contractors use adequate cost and schedule control systems and provide cost and schedule status to the Army's project managers.

I regret to announce the death of two individuals who were associated with us. . . . Mrs. Clarence D. Davis died July 13, 1991, in Belle Mead, N.J. She is survived by her daughter, Susan M. Girardi. Her husband pre-deceased her. . . . **Capt. Stanley Alexander** died December 20, 1991, in Weston, Mass., after a lengthy illness. He graduated from the Naval Academy in 1930 and received degrees from MIT with our class. He was employed by the Bath Iron Works as supervisor of shipbuilding for 30 years and spent 10 years with Mitre Corp. as assistant to the president. He is survived by his wife, Lois, a brother and sister, and son Jefford Scott of Raynham, Mass. I am sending our condolences to the survivors.

The weather here in southern California is fabulous, but my golf continues its long roll downhill.—**Allan Q. Mowatt**, secretary, 715 N. Broadway, #257, Escondido, CA 92025, (619) 432-6446

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Year-end greetings and messages to **Pat Patterson** and/or me. . . . **Charlie Holman** and Lucy continue hunting, fishing, and skeet shooting, resulting in a full freezer of game birds and fish, plus more trophies on their mantel. . . . **Gordon Thomas** and Mary Lou reported 25 degrees below zero at their place in Quebec in December, after visiting their five children in Alaska and California earlier. . . . **Bob Walker** mentioned his being an amateur magician, and on the telephone he recalled meeting the great Blackstone backstage in 1933 at a Boston vaudeville theatre. Bob attended the 55th Reunion, hobbling a little with artificial underpinnings, but still able to travel to house-sit for his children in the Midwest.

Ruth and Henry Lippitt's newsletter tells of 11 weeks at their Swiss condo and a trip to the wedding of an Austrian-branch Lippitt. This branch began around 1840, when Henry's great-great uncle

followed his Harvard professor to Vienna, later became secretary to the American Legation, and "with great presence of mind" married the daughter of the Bank of Austria's chairman. After the newsletter, Henry had open heart surgery for a ventricular defibrillator implant: "I still feel frail and at age 76 recuperation is slow, but with patience and Ruth's good care I'll regain my strength." Henry forwarded a photo card of Janet and **Bob Gillette** on their Mason 44 in Quisset Harbor.

A letter to Pat from **Ro Ortynsky** reported the 75th anniversary celebration of the Chemical Engineering Practice School last October, where he saw **Herb Borden**. **Bill Rousseau** had a major part in organizing the affair, and his 1936 group of fellowship endowers (see Aug.-Sept. '90 Notes) was represented by **George Putnam**, **John Roberts**, and **Kelly Woods**. Ro's letter also mentioned the ROTC drill problems of a short man on the outside of a wheeling rank of six-foot-tall fellow freshmen. . . . Recently, Pat attended a Union Carbide-Linde Division reunion of people who worked on the Manhattan Project during the war. . . . **Dottie and Tony Hittl**'s letter told of visiting six different colleges in the Midwest and East for her reunion, a family graduation, a bridge festival, etc. Their travel plans for 1992 include Kenya.

My October report of visiting **Al Horton** reminded Jim Laubach, '39, of Al's leading that year's Thorne-Loomis trip to Europe. Jim writes of it as "the greatest experience in my two years at MIT. We were doubly fortunate in returning two weeks before Hitler's blitzkrieg began." . . . The 1963 Baldwin Hills, Calif., reservoir failure mentioned in Nov.-Dec. '91 Notes, and **Bernie Gordon**'s part in finding the cause, meant little to this former Easterner until I saw a recent PBS television documentary on the Johnstown, Pa., flood of 1889 and its 2,200 deaths. Bernie's appraisal is that the Baldwin toll of five deaths might have been several hundred if it had happened at night as at Johnstown, rather than at noontime. Much of Bernie's career has been devoted to preventing such catastrophes, teaching and lecturing on soil mechanics at universities, and advising state and federal groups on dam construction and perpetual inspection for telltale signs of deterioration. He is conducting a course this spring for the University of Missouri.

Sailors ahoy! **Slim Beckwith** has a granddaughter working on the staff of America³, the organization of Bill Koch, '62, seeking to defend the America's Cup this spring off San Diego. In January, Grandpa Slim had a seat on Koch's spectator boat for the second defender trial race, "perfect for watching over each of the eight legs." His *Defiant* beat *Conner's Stars and Stripes*.

A December note from **Chuck Kennedy**'s widow Roselynn carried *Elmira Star-Gazette* clippings telling more of Chuck's honors, including founding the statewide Chamber of Commerce and trusteeship of Elmira College, and of his integrity and good humor. And I like a son's comment on seeing a 1934 picture of the Institute varsity basketball team (Chuck was captain-elect): "Mom, what a handsome hunk of man you married!" . . . Cheers also for the lives of **D. Elliot Cullaty** and **Carl Peterson**. . . . Elliot died June 9, 1988, but notice apparently was waylaid; his widow Bette has continued annual contributions to the Alumni/ae Fund. Over some 30 years he rose to be president of J.F. Bingham Co., sheet-metal fabricators in Lawrence, Mass. Elliott was Course IV and employed his artistic talent by sculpting gifts for family and friends. He served as adviser to boys at the Andover Vocational School and was a director of the Arlington Savings Bank. Bette continues at 49 Possum Rd., Weston, MA 02193.

Carl Peterson, Course XV, died last October 3 of pneumonia after years of chronic leukemia. He had retired in 1969 as director of salary administration for Pittsburgh Plate Glass. During World War II, while assigned to a base in Texas, he played golf often with up-and-coming Ben Hogan, a fellow Air Force officer. Years later at a tournament at Carl's club, Ben looked him up on the club roster to renew

their friendship. His widow Joan said Carl was very brave throughout his long illness and never complained. She continues their residence at 507 Broadmoor Ave., Pittsburgh, PA 15228.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

37 55th Reunion

Countdown time to our 55th Reunion! We hope many of you are planning to attend.

Joe Smedile reports that Martha, with continuing therapy, has made good progress in her recovery from a major stroke in mid-June 1991. . . . Ruth and **Phil Peters** are still using their new coop apartment at Fox Hill Village in Westwood, Mass., but spending ever more time at their Jackson, N.H., mountainside home. Phil writes that it has become their principal residence and they are now qualified to vote at the old-fashioned Jackson Town Meeting. Their address is Juniper Hill, Ten Mile Rd., P.O. Box 272, Jackson, NH 03846. . . . **John Nugent** spent four days in January 1991 at Clifford Memorial Hospital, Vt., having a prostate operation. He came through with flying colors and expects to attend the reunion.

At Christmas, **Ed Hobson** reported the activities of his extensive family, all of whom seem to be busy and in good health. Ed follows his daily rigorous exercise regimen. He's enjoyed trips to Florida, upstate New York, Holland, Belgium, and England, plus motor trips to North Carolina, Pennsylvania, and Virginia. He finds the twice-monthly visits with the Abanaki staff both stimulating and enjoyable. . . . **Joe Heal** reports from Mystic, Conn., that Marion has improved from her numerous medical problems and the progression of Parkinson's disease, so that she can come home from the nursing home during the day.

Elvie and Norm Birch are enjoying his retirement. They spend summers in Carver, Mass., and winters at Lakeland, Fla., with trips in between. . . . **Charlie Antoni** retired in 1983 as professor of civil engineering at Syracuse University. Recently he has been serving as a construction arbitrator for the American Arbitration Association. Charlie enjoyed the pictures and comments in recent issues of *Civil Engineering at MIT* about *Benchmark*, Camp Technology's publication. All who attended the camp in Machias, Maine, have fond memories (I believe that 1935 was the last year of the camp operation). Charlie and his wife Elinor plan to be at our 55th Reunion. We hope to have a photo taken of the Camp Technology alumni.

Becky and Dave Tuttle also are planning to be at our reunion. Dave retired in 1979 as professor of electrical engineering at Stanford University. Post-retirement, he taught at Georgia Tech, San Francisco State University, Amherst College, and at Stanford in France. Otherwise, he keeps busy with reading, some traveling, differential equations study, and writing (using a computer). . . . **Gil Mott** retired in 1982 as VP of planning, Olin Corp. He is trustee and chair of the Development Committee of the Bridgeport Engineering Institute, VP of the Council of Churches of Greater Bridgeport, VP of the Greater Bridgeport Symphony, and volunteer consultant for the National Executive Service Corps. His hobbies are tennis and golf. Gil's suggestion for the reunion—"Have good weather."

It is with sadness that I report the death of **George F. Wollinger, Jr.**, on November 19, 1991. George returned to college to learn about computers and for several years wrote his own programs. He attended professional video shows and became an expert on the subject. Our condolences to his wife, Rose.—**Robert H. Thorson**, secretary, 66 Swan Rd., Winchester, MA 01890.

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The annual 1938 mini-reunion will be held at Endicott House on the evening of Technology Day,

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June 5. Notices have been sent only to area residents, to past participants, and to those who have expressed an interest, but everybody is welcome. If you can't make it this year but want to be on the list for '94 and after, tell Don. After this year it will probably be held somewhere else: if you have any ideas, tell Don or me.

This is the kind of news I almost enjoy reporting—no deaths, hospitals, or ailments. Of course, there's also very little news. As I write this, Phyl and Don Severance are just back from four days of skiing at Bretton Woods and left yesterday for a week in Bermuda with Elderhostel. . . . In November, Madelyn and Paul Des Jardins, after spending most of their adult lives in New Jersey, moved to McLean, Va. Paul, with Madelyn's help, spent a lot of time and effort successfully soliciting for the Alumni fund and the 1938 Scholarship Fund in New Jersey; Fairfax County, watch out!

Over the past half-century we have come to know and love the spouses of our classmates, often even more than our own classmates themselves. They have been not only a vital part of our quinquennial reunions but constant friends and neighbors as well. Unfortunately, when the classmate dies, the Institute and we tend to lose track of the spouse and family. We're compiling a list of names and addresses so we can keep in touch. Please send all the info you can to Don.

The 55th Reunion plans are proceeding apace under the chairmanship of Norm Bedford. At a committee meeting on January 14, attended by all but icebound Frank Gardner, the following program was outlined. On Monday June 7, 1993, an informal get-together and dinner somewhere in Cambridge.

We'll give you info later on local hotels for that night. Also, several of the nearby residents have offered B&B facilities. The reunion actually starts Tuesday morning with a bus and ferry ride to the Harbor View Hotel in Martha's Vineyard where we'll relax before the class banquet. Wednesday is scheduled for recreation, shopping, and a clambake. On Thursday we return to McCormick Hall, pre-Pops, and the traditional concert, spending the night there. Friday, of course, is Technology Day, after which we disperse. Please let us know if you have movies, ideas, or slides for Tuesday or Wednesday. We'll see you then.—Don Severance, secretary, 39 Hampshire Rd., Wellesley, MA 02181; Ed Hadley, assistant secretary, 50 Spofford Rd., Buxford, MA 01921

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Harold Pope and Vonnie divide their year between three homes. Harold's undergraduate studies led him to meet Walt Mykytow, Gordon Pope, and Hew Phillips, and he maintained business and personal associations with them over the years. Harold and Gordon Pope shared duties as members of the board of Daniel Webster College. Walt Mykytow, retired from the Airforce at Wright Field, now lives in Weymouth. Harold's career included successes in aircraft and instrumentation industries, but his venture to encourage lobsters to increase their growth rate is a fish story that needs a class reunion for the telling.

Jim Laubach and Ruth are back in Brattleboro, Vt., after a fun trip to the Galapagos Islands, about 600 miles west of Ecuador. They plan to visit Alaska next.

Bob Withington and Betsy fly from their waterfront home on Lake Washington to ski at Aspen and in British Columbia. One of Bob's first assignments at Boeing was to join Bill Cook, '38, to design and construct a high-speed-air tunnel. Experiments in the tunnel led to design refinements and eventually to the 707. Bill Book's new book *The Road to the 707* (published by the TYC Publishing Co. in Bellevue, Wash.) is comprehensive, fascinating, and enthusiastically recommended.

Hew Phillips and Viola stopped over in Seattle months ago and, at a '39er mini-reunion, conducted a stimulating seminar on the several-second-duration flight in England in the 1890s of a biplane,

designed and built by Maxim and powered by a reciprocating steam engine! Having been personally enchanted with steam engines since 1946, I asked Hew questions about Maxim's engine which were answered in an article Hew sent after returning to Hampton, Va. For fascinating reading, try the November 30, 1894 *Journal of the Society of Arts* article, "Experiments in Aeronautics" written by Hiram S. Maxim.

Bob Sackheim and Betsy and Bill Pulver and Adie take an interest in the Puzzle Corner of the *Review*. What's more important, they can even solve some of the problems. . . . Seymour Sheinkopf and Sylvia plan more travel in their silver bullet trailer, this time to the Southwest. They report Barry Graham and Jean were visited recently in Ontario by Fred Grant and Ginny. Barry says there is a difference between making aluminum ingot for Alcan and production with his word processor.

Bob Touzalin and Aletta consented to coordinate activities for '39ers at a mini-reunion scheduled for January 4-7, 1993, in Naples, Fla., and to include classes '38, '39, '40, and '41. About 30 '39ers now reside in Florida and others have expressed interest in "in-between" class reunions as well. Bob and Aletta welcome helping hands and invite volunteers. Write Bob and Aletta at 279 Mel-Jen Dr., Naples, FL 33942.

Ernie Kaswell and Yolande were not too busy migrating southward to send me a photocopy of the article "Still Twisting" published in the Sept.-Oct. 1991 edition of *American Scientific* magazine, which concerned the fatal twisting in 1940 of the then new Tacoma Narrows Suspension Bridge. Hilda and I lived for several years in a house on the westside bank about 1,000 feet south of the replacement bridge. George Cremer's dad, also an MIT graduate, earned fame from his career accomplishments in other suspension bridges, and George expressed interest in Tacoma's replacement bridge as we sat one day on our deck, and discussed the bridge collapse and its aftermath. I sent photocopies to George at Lemon Grove, Calif., where they will evoke double pleasure.

John Renshaw and Lolita reside in lovely Hillsboro, Calif. As chair of Van Strum and Towne, John was recently interviewed and his comments, for *Money Manager Interviews*, were published in four pages by the Wall Street Transcript Corp. . . . Morrie Nicholson and Norma report from St. Paul that Morrie survived nicely two aneoplastic adventures. Morrie is in good voice and looks forward to the afterglows at our 55th in '94.

We are saddened by reports of deaths of two classmates: Charles A. Lawrence, Jr., on July 12, 1991, in Seattle; and Robert R. Chase, January 10, 1991, in Austin, Tex. There were no details.—Hal Seykota, secretary, 2853 Claremont Dr., Tacoma, WA 98407

40

In October, the School of Chemical Engineering Practice had a 75th anniversary celebration. A bulletin was sent to all Practice School graduates, so I was on the mailing list. Our class was fairly well represented by James Baird, Russell Haden, Charles Stokes, and Kenneth Walker. Not present but mentioned in the report was Jerry McAfee, who led the Practice School fundraising in the 1980s.

There have been two letters from Class President Norman Klivans regarding the January, 1993 mini-reunion in Naples, Fla. Based on the positive response to the questionnaire, he is confirming arrangements with the Naples Beach Hotel. A minimum of 40 MIT graduates must be confirmed by August 1, 1992. With significant interest from the classes of 1939 and 1941, and Norm's expectation of involving the classes of 1938 and 1942, having 40 present should be no problem. A budget should be ready about the time you read this column.

Tentative activities include a cocktail party, trips to Corkscrew Swamp or the Everglades, a harbor boat cruise, fishing trip, house tours, and shopping in Olde Naples. And, of course, there is golf, tennis, the beach, Lolly-The-Trolley rides, and other fun

choices. In the event of rain, there might be trips to the Edison and Ford homes in Fort Myers and films from MIT. Norm is hoping that Paul and Priscilla Gray or one of our old friends from MIT will also be present. By this time, the hotel has been given a confirmation, with a deposit due in September.

On January 26, 1992, our second vice-president, Martin Abkowitz, passed away. The *Boston Globe* carried a news story about him. It said he was "professor emeritus of ocean engineering at MIT and an authority on the motion and control of ships. He was responsible for the design, construction, and operation of the MIT Ship Model Towing Tank. His teaching and research focused on the movements of ships in waves and the stability of ships and submarines. He received a master's degree in naval architecture from MIT in 1949, and a PhD in physics from Harvard in 1953. He served as a captain in the Army Transportation Corps during World War II. He joined MIT's former Department of Naval Architecture and Marine Engineering faculty in 1949, became an associate professor in 1954, and professor in 1959. He retired in 1988." Donations in his memory may be made to Martin Abkowitz Memorial Fund and mailed to the Dept. of Ocean Engineering, MIT, Rm. 5-228, Cambridge, MA 02139.

Louis B. Tura died on December 28, 1991. Of him, the *Boston Globe* wrote, he was "a retired vice president of Aberthaw Construction Co. who supervised the building of the Kennedy Memorial in Washington and the Christian Science Center in Boston. After retiring from Aberthaw, Mr. Tura worked as an executive with Sanvel Corp. of Littleton, another construction firm, until 1984. He served with the Navy's Seabees during World War II."

Lawrence Jones called recently and told me that he had been involved in the preparation for the moon landing. He had also worked as an advisory engineer at Westinghouse in Baltimore as an analyzer on computer languages for future use. Larry received his doctorate in mathematics in June 1946. Currently, he is searching for a new basis for math, based on concepts of dynamics. . . . I also had a telephone call from George Wolfe, who is still involved in many community activities and also assists his brother in the operation of a travel agency.

Treasurer Richard Babish sent me another response to the questionnaire, this one written by the conservator for Boger Wright. She wrote, "Boger has asked me to send this check. He was broken-hearted that he could not attend the big reunion this year. He lives in a Supervised Retirement Home, very content there. He can go out to lunch with friends, and to church. I doubt if he will be able to journey to Boston ever again, but he hopes to. Please continue to send communications to him. I will keep you posted of any changes."

Among other responses to the mini-reunion questionnaire was one from John Kapinos. He would like to see a list of alumni willing to offer their homes for mutually arranged short visits by alumni friends who wish to meet and do something in the host area. He says, "The last guys who offered this kind of hospitality to me were Wally Schuchard (Hingham area) and the late Gary Wright (Ozarks). I had Sally (Mrs. Bob) Bittenbender here along with an MIT '38 pal and his wife (all from the Boston area), who made my home an overnight rest stop [on the way to] a Sunday concert of the BSO at Tanglewood."

In his questionnaire response, Kingsbury Jackson writes, "Thanks for your concern for our health. I expect to outlive you all! The reunions are doubtful, but you all have my best regards." . . . And from Robert Harper, "55th in Newport, R.I., at Viking a great idea. We had a Navy reunion there a few years ago-and it worked out well for all." . . . Robert Gould had a problem. "Proposed '93 reunion interferes with my usual New Hampshire skiing. Once skiing starts, it's hard to break away from here. Keep me posted. We might make the supreme sacrifice!" . . . David Fleming thinks the idea of the mini-reunion sounds great, but it is too early for him to make the commitment. He had planned to

attend the 50th, but his son had to undergo surgery at that time, so family took top priority. . . . **Metchie Budka** wants no more reunions. He says, "I defected from MIT to Harvard, but I always had a warm spot in my heart for MIT, especially for Walker Library, and the then librarian."

Marshall McCuen comments, "We don't very much like Florida, but we could make this an exception. Would like to see Naples, as we have many friends who go there. As I have done for the 14 years of my retirement, I fill my time with volunteer work and travels. My artificial hip joint keeps me from all sports but swimming." . . . **Paul Witherell** doubts that he will go to Naples, but won't "close the door yet." . . . And from **James Moore**, "Just finished three-year stint as chair of the board of North Conway Resource Conservation and Development Area, Inc. Will draw back to director and chair of Water Resources Committee in January. We go to the Southwest rather than Florida in the spring, but will consider possibility of a side trip to Naples." . . . And finally, **Michael Biancardi** says that he has been wintering near San Antonio, Tex. As he hopes to continue, he doubts that he would be able to attend a reunion in Florida.

I look forward to more letters and telephone calls from you to keep the column going. Send them to:—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

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A January 9 letter from **Sepp Dietzgen** reads: "Just got back from the West Coast where my granddaughter, Kelsey, is training to become a star gymnast. Before that, Peg and I enrolled in a television workshop. At the end of our class, I became a producer and presented, in the form of a profile series, the new acquisition of open space for the village of Cotuit. Our little group now manages about 135 acres of land: a lake and a cedar swamp. The IRS wanted us to enlarge our membership, and our appeal to the Cape Cod Cable viewers accomplished this objective."

Sepp received a letter from **Peter Smolka**, patent attorney (chemistry) in Alexandria, Va.: "In June 1992, we hope to go to Western Ireland for another of Margie's watercolor workshops, then to England and the Continent. Maybe we can take Katie to Prague to show her where this ancestor of hers was growing up at a time roughly between now and Abraham Lincoln's assassination. . . . Other diversions during 1992 included my prostatectomy (non-malignant). Surgery took the stuffing out of me, but now I have regained my strength." Peter comments on the end of the communist era: "Newly found freedom, coupled with economic difficulties, is leading people back to atavistic nationalism, not only in Yugoslavia but also in Czechoslovakia, in parts of Russia, and even in Quebec."

Mini-reunion news from Sepp: He is planning a dinner with a faculty speaker for '41ers in the Boston area at Commencement time—June 3, 6 p.m., at the MIT Faculty Club. You can still sign up through Eliza Dame at the Alumni/ae Office, (617) 253-8230. Sepp also relays an invitation from Norm Klivans, '40, for a Classes of 1938-41 mini-reunion at the Naples Beach and Golf Club, Naples, Fla., January 4-7, 1993. In addition to those who will enjoy the four-day package, residents or vacationers within striking distance are welcome to the dinners, cocktail parties, and other special functions. Those interested should contact Norm at 3124 Bremerton Rd., Cleveland, OH 44124, (216) 464-3332, as soon as possible, deadline July 1, 1992! **John Mullen**, who owns a home in the Naples area, is enthusiastic and offered to be the '41 coordinator. At this time of year (spring-summer), he can be reached in Nantucket, Mass., (508) 228-9545.

The American Institute of Aeronautics and Astronautics announced the election of **Jim Mar** as an honorary fellow of the institute at their annual meeting in April 1992. Presented only to exceptional individuals who embody the highest possible

standards in the aeronautics and astronautics field, the honorary fellow is the highest accolade that can be bestowed by AIAA and its board of directors. Up to three individuals are selected each year, individuals with long and contributory careers in aerospace. Jim graduated with us and later received an MS and ScD in Course I from MIT. He was Hunsacker Professor of Aeronautics and Astronautics at MIT and a recognized expert on aircraft structures and materials. In 1975, as a member of a NASA committee, he helped us decide how to correct stress corrosion faults in the booster stage just before our 1975 flight with the Russians. As a result of this contact and his invitation, I had an interesting day presenting a seminar to the MIT Course XVI students about the Apollo-Soyuz Program.

Will Mott has agreed to become class agent replacing **Bob DeMartini**, who has held the job for about as long as I can remember. Our thanks to Bob for his outstanding work and to Will for taking up the load.

Art Covitt notes on his return to the Alumni/ae Association: "On a recent family visit, our oldest granddaughter, age 10 (one of five grandchildren), volunteered a mild interest in becoming a fourth generation MIT student!"—**Charles H. King**, Jr., secretary, 7509 Sebago Rd., Bethesda, MD 20817, (301) 229-4459

42 50th Reunion

By the time you read these notes, it will be too late to persuade your attendance at our 50th Reunion and too early to report about the festivities!

News from **Frank Seeley** that he finally got his doctorate in education from Florida University makes Frank winner of the longest route to a doctorate thus far, but the game is still open. Let me know who among you is in the competition. . . . Norm Klivans, '40, invites one and all to a mini-reunion in Naples, Fla., January 4-7, 1993. If interested, you can reach Norm at Suite #401, 10701 Gulf Shore Dr., Naples, FL 33963, (813) 597-2018.

Attended a meeting of the very active MIT Club of Tampa Bay with Joan and Dick Knight, '47, and not-so-long-ago secretary of the Alumni/ae Association. Dick and Joan live not far from here on the bayside of Clearwater during the winter and still have a summer home in Canada.

Two obits this month—**Don Stein** in Falls Church, Va., and **Larry Beckley** in Winchester, Mass. Condolences to their families.—**Ken Rosett**, secretary, 281 Martling Ave., Tarrytown, NY 10591

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Jim Hoey continues to report on the "Great Cape Cod Septage Stink," mentioned in the last issue of class notes, which has enveloped **Gene Eisenberg** and his engineering/architectural firm, the LEA Group. In a letter responding to the critical editorial in the *Cape Codder*, a Class of '88 alumnus leaps to the defense of MIT while distancing himself somewhat from Gene and the controversial septage plant. No doubt Gene has always wanted a friend like that, but not very much.

A note has come from **Rudy Hurwich** in the independent city-state of Berkeley, Calif. Rudy has started a new firm, PolyPlus Battery Co., for the development of a solid-state lithium polymer battery. This innovation is based on an organic electrode material invented at University of California's Lawrence Berkeley Lab.

Jim Hoey thinks that **Jim Spitz** and **Stan Proctor** should be gathering large quantities of news in the course of their 50th Reunion fund raising. How about it, fellows?—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

Arturo Morales Dominguez writes from Mexico City that he is looking forward to attending our

V-12 Reunion at MIT

In November 1993, the Navy will celebrate the 50th anniversary of the V-12 program. The Alumni/ae Association would like to organize a reunion for those who went through the program at MIT. The records for V-12 alumni are incomplete, so we need to develop a mailing list of all who might want to come. If you were a V-12 student at MIT, please send your name and address (and also the names and addresses of others with whom you are still in touch) to Clinton Springer, '45, c/o Robert Dimmick, MIT Alumni/ae Association, Rm. 10-110, 77 Mass. Ave., Cambridge, MA 02139. □

50th Reunion. He is still very active in the Mexican Academy of Engineering. . . . **Paul Robinson, Jr.**, reports he retired June 1, 1990, from the Naval Computer and Telecommunications Command, where he was an information systems engineer. He continues to fly his Cessna 172 Sky Hawk on trips and to Florida for SCUBA diving. He has kept in touch with his roommates, in particular, **Robert Veitch** of Huntington, N.Y.

Mardi Bettes sends additional information about her father: **Richard S. Bettes, Jr.**, died at home in Mountain Lake, N.J., on August 18, 1990; he was 67 years old. A native of Springfield, Mass., Dick was captain of the golf and hockey teams while at MIT and a member of Delta Tau Delta fraternity and The Tau Beta Pi honorary society. After serving in World War II, he worked for Standard Oil of Indiana and obtained a PhD from Illinois IT, then moved east to do classified communications work for Bell Labs. In 1972 he became a principal engineer for Ebasco Services in New York City, where he did program engineering for nuclear power plants. He retired in 1986. Ignoring an eight-year battle with cancer, Dick remained active until his death. During his final year, he sailed off the California coast with his daughter Mardi and her husband, Doug Morrow ('79), skied various New England trails with his son Rick and two grandsons, and climbed and skied Tuckerman's Ravine in the White Mountains with his daughter Barbara. His wife Donna predeceased him in 1984.

Katherine (Adams) Kulmala passed away from cancer at her home in Carlisle, Mass., on January 5, 1992. She was former editor of the *Carlisle Mosquito*, the town's weekly newspaper, former chair of the Carlisle Zoning Board's wetlands subcommittee, and author of the 1976 zoning by-law that protects the town's wetlands from development. Born in Boston, she graduated from Beaver Country Day School in 1939 and from MIT with a degree in architecture in 1944. She received a master's degree in city planning at MIT in 1953. She joined the Planning Service Group of Cambridge, consultants on master plans for small towns, in 1956 and became president and managing owner in 1984. She leaves a stepdaughter, Laura Bojkovic of Helsinki; a sister-in-law, Mary Adams of Cambridge; a nephew, Faneuil Adams, Jr., of New York; and two nieces, Margaret T. Adams of Bethesda, Md., and Joan P. Adams of Branford, Conn. We extend our sympathy to their families.

Now hear this, now hear this—all you Navy men who were in the V-12 unit at MIT in 1944-45. Clinton Springer, Class of 1945 secretary, has written asking our help in publicizing a possible reunion of all V-12 men. November 1993 is the 50th anniversary of the program. Clinton is working

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with the Alumni/ae Association on an MIT V-12 reunion activity. He would like to hear from all V-12 men who are interested. Respond to him at P.O. Box 288, New Castle, NH 03854. Watch here for more on this.—Co-secretaries: **Andrew Corry**, P.O. Box 310, W. Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

45

On January 15, we lost one of our class stalwarts, **Charles H. Hart III**. Charles and his wife Nancy have had a near perfect attendance record as respects any and all class activities since graduation. If ever there was a class job to be done, Charlie could be counted upon. The following classmates attended the January 25 Memorial Service at the Community United Methodist Church Cochituate Village in Wayland: Carol and **Jim Pickel**, Louise and **Tom McNamara**, **Bill Meade**, **Mary Trageser**, **Dee and Frank Gallagher**, Janice and **David Flood**, Anne and **Bob Maglathlin**, and yours truly. We should not forget the Don Severances, '38, who were square dancing mates of the Harts.

Jim Pickel spoke about his early association with Charlie who happened to be an Army brat who came to Cambridge from Alaska. Jim met Charlie at Freshman Camp where he learned of Charlie's apprehension that some of his future classmates knew more about physics and math than his high school instructors! Jim and Charlie went on to own jointly a 1934 Chevrolet junkie and later a vacation retreat in Vermont. Their closest association was a love for classical music coupled with the inability to play such music.

Other Memorial speakers talked about Charlie's 36 year love affair with Wayland conservation and archeology, square dancing, and his great enthusiasm and persistence in all activities. We share your loss, Nancy.

George K. Landon, Jr., a long time resident of

New Canaan, Conn., died in Hilton Head, N.C., on November 21, 1991. "Dapper," as he was known by many, joined Continental Can following Navy duty and retired to Hilton Head some 40 years later. During his tenure at Continental, George managed the Bondware Flexible Packaging, and Plastics Divisions, retiring from the latter as vice-president and general manager. George is survived by his wife Ruth a daughter, two sons, plus four grandchildren.

Emmett E. Day reports: "I am enjoying my retirement from the University of Washington. In winter, skiing in the Great Northwest and boating in New Zealand. In summer, boating in the U.S. and Canadian San Juans and travelling to interesting and exotic places—makes one jealous, doesn't it!" ... **John S. Hawkins** reports: "Am retiring after 45 years with Ingalls Ship building in Pascagoula, Miss., nine years evaporated in the Engineering Division (naval architecture), 18 months went to nuclear engineering and on the job training at a naval shipyard, 21 years were consumed in installing, overhauling, and refueling submarine reactor plants, and 13 years have been eaten as a facilities engineer—heavy lifts and specialties. The last stint was the most satisfying." John, as a frustrated naval architect, I often wondered what shipyard life might have been!

And now for a few one liners from Christmas '91: Anne and **Bob Maglathlin** spent several weeks in Alaska last summer—and Bob is filled with wild fish stories! The Maglathlin boys failed to advise their parents of Hurricane Bob's destruction so Bob and Anne were unpleasantly surprised when they arrived in Wareham two days following the storm. Anne's hip replacement is working fine. ... After 31 years in their grand Greenwich mansion, Jean and **Prexy Chris Boland** have moved to a Stamford, Conn., condo about one block from where Fran and I lived for many years. We will be vacationing with Chris and Jean in London in late April. ... **Tom McNamara** advises that Louise is so

busy teaching that they will not be able to take their usual lengthy spring vacation; Tom dares not go alone!

Carol and **Nick Mumford** continue to have grandchildren—24 by the time you read these notes. Any challengers? We hope to see the Mumfords when Nick comes East next fall to attend his 50th from Moses Brown School in Providence, R.I. ... Katy and **Jake Freiburger**'s card pictured the Freibergers on skis in the mountains of Colorado; they were not in motion, however! ... **Jimmie Stephenson** complained that Tom was playing too much golf. If golf is similar to sailing, it is difficult to believe that there is such a thing as too much. ... Edna and **JJ Strnad**'s card included two pictures: a bride and groom of April 1951 plus a 40th anniversary update. They haven't changed (too much!).

As we pen these notes, Ellen and **Jim Brayton** are skiing in Switzerland. ... Barb and **George Bickford**'s note brought back memories of a bygone era, as there was a mention of Grafton, Mass., George's old home town. I can remember my Factory Mutual inspection days and visits there to Whitin Machine where old Curly was a struggling young engineer. Whitin Machine, long since deceased, was the largest textile machine manufacturer in the world. ... **Suna and Art Hall** appear to have the best of both worlds; Florida, the Bahamas, plus Colorado skiing in the winter and down East Maine in the summer. Eat your hearts out, comrades! ... **Max Ruehrmund** has survived two heart attacks but appears to be thriving at the moment.

Jerry Paterson continues to be in the structural steel business down Texas way. The 15-person family photo of children and grandchildren brought back memories to us as it must be 36 years ago that we visited this clan in Binghamton, N.Y., where we say Jerry star in a local Verdes production. ... Oops, I nearly forgot to mention the birth of our second grandchild, Cameron Hennigan Springer, son of

Karen and Jonathan, on January 21.

That's it for now.—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

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Another year; another year of MIT students supported (in part) by our Class of '46 Scholarship Fund. Still with us are: Christopher Wren, now a junior and still a computer science major, who works at the MIT Media Lab "year 'round." Somehow he manages to run around a flock of outside interests including athletics, designing kites, and playing the Spanish guitar. Sarah King, who was scheduled to get her degree in management related to the health field, still finds time to work in community service both at MIT and in the Chinese community. Makie Tam (from Linden, N.J.) is in her junior year in architecture, becoming a member of the American Institute of Architecture Students (AIAS). Ballet and aerobics take up her spare time. Susanne Choe, who wrote **John Gunnarson** last year thanking us all for our support, continues to be an outstanding student in pursuit of her goal to become a physician, working at community service, tutoring, and volunteering in the inner-city hospitals!

Added to this fine group are new students in their sophomore and junior years: Paul Mangione, from the Bronx, is majoring in computer science and is an Eagle Scout who serves as an assistant Scoutmaster. He participates in the 6A program, enabling him to obtain both bachelor and master's degrees in five years. Marie Castro, a sophomore from Anaheim, Calif., is concentrating on computer science. When not in class she designs posters for the MIT Lecture Series Committee and devotes much of her vacation time to informing potential students about life at MIT. Scott Velazquez, a junior from San Diego, is majoring in electrical engineering and hopes to carry through to a PhD. His greatest love is playing his guitar and he spends much of his time in audio recording. They sound like a great group!

A couple of short notes from our class, passed along by the *Tech Review*, tell us that an old XVI buddy, **Ed Potter, Jr.**, retired from Norden Systems three years ago, and is now busily calling square and contra dances every week, and visiting (7) grandchildren. In between, he's an engineering consultant. He still lives in Westport, Conn. . . . **John M. Dudley**, who has been professor of physics at Colby College to these many years has retired (in Waterville, Maine), and was last heard taking a trip to Honolulu.

Two sad notes, however belated, include **John McMillin**, a course XV grad who died a year ago in Cincinnati. His daughter was kind enough not only to let us know, but to send a nice gift to the MIT Scholarship Fund. An obit, sent by a Class '36 friend, Lawrence Peterson, from Schenectady, tells of the January passage of **Daniel Streeter, Jr.**, a Course II grad with a master's in '51. It's not clear where he got his PhD, but he spent years in Seattle at the Univ. of Washington School of Medicine in pathology and later in Columbus, Ohio, in bioengineering mechanics. At the time of his death Dr. Streeter owned and operated an engineering company in Berlin, N.Y. He was survived by his wife, a son, and a daughter.

We hope you all are surviving. Let us know!—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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45th Reunion

Fred Heuchling has retired and figured out where to spend his time to enjoy each season at its best—winters in Naples, Fla., summers in Muskoka, Ontario, Canada, and spring and fall at home in Wooster, Ohio. Fred says he's going to try and make the 45th—see you there, Fred. . . . **Ed Kane** took early retirement from Combustion Engineering (didn't tell us when) and has been consulting in industrial marketing since then, mostly in the field of environmental engineering. He's been back to the

Institute occasionally and he, too, hopes to make the 45th.

John DeBell died December 14, 1991, at his home in Toms River, N.J. He had worked for a time at DuPont Laboratories and assisted in the early development of TV sets. He is survived by his wife, Joan, two daughters, three brothers, a sister, and four grandchildren. . . . **George Fichtenbaum** died in late December 1991 in New York City. He was the executive director of the American Society of Travel Agents from 1967 to 1974 and wrote the history of the organization, "Passport to the World." Later he was president of American Sightseeing International, a network of tour companies, and then executive VP of the Travel Industry Association of America. He retired in 1987. He is survived by his wife, Gloria, three daughters, one sister, and two grandsons.—**Robert E. McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Plans are underway to celebrate the 50th anniversary of the Navy V-12 program (see box, this section).

Nancy and **Don Noble** have grandchildren who live in Denver, Vermont, and near their home in Hingham. During a visit to Denver, Don and Nancy spent one night in a cabin at 11,000 feet. Don played golf while they were there. Their daughter, Stacie, did a short residency program at a medical clinic in Nassau, Bahamas. Another daughter is writing descriptions of houses and whole towns in Vermont for the *National Historical Register*. . . . **Ed Kratovil's** wife, Suzanne, had a surgical hip replacement last October. . . . **Jim Guida** is pushing 75 and his current health is pretty good. He had heart bypass surgery in November 1990 and further surgery in July 1991.

Walt Chaiko and his wife love their life in New Bern, N.C. They celebrated their fifth year there and have made many new friendships. They are busy with sailing, cruising, tennis, socials, travel, organizational activities, etc. Walt has done some engineering consulting. . . . **Elton Hammond** and his wife, Kitty, have decided "retirement" is a misnomer. Elton is a volunteer in the AARP Tax Aide program, American Youth Hostels (council president), and church finances. He is also a leader of bicycle/hiking trips. A big trip in 1991 was a bike/cruise week in the Caribbean—mileage was low but altitude changes (climbs) and wind forces high! . . . **Stuart Thayer** was elected an honorary VP for life of the Society of Naval Architects and Marine Engineers.

Roy Oringer died in November. He operated a family business making confectionary supplies in Weymouth, Mass. He retired in 1987 when the business was sold. . . . **Ellsworth Annis** died last August. Ellsworth is survived by his wife, Eileen. On behalf of our classmates, I extend our sympathy to Eileen and to the families of both classmates.

My son, Laurence Billett, joined Salomon Brothers investment banking in 1990 as a director in the transportation group. He had been with Pan Am for 12 years and rose to senior VP, corporate finance. Larry moved to London to head Salomon's infrastructure finance activities. He has also been in touch with governments in eastern Europe about projects related to privatization. Recently, he represented Salomon during the structuring of a deal for the government of Greece to solicit proposals to build a multi-billion dollar national airport.

The manufacturer's representative activities that kept me busy for the last 11 years reached a peak of income in 1987. By September 1991, revenues were only 20 percent of the peak level, so I signed up with a temporary help firm as a computer operator. They sent me to a new company using a screen printing process to apply images and patterns to polyester sheets, where I am working 20 hours per week as a consultant in quality control, engineering, and computers.

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I have continued to pursue the manufacturer's rep business, with product lines ranging from a \$550,000 focused ion beam for milling areas that are fractions of a micron on silicon chips to filters for liquids as low as \$3.50 each. Last summer the 110 sailboat that I race needed a major reconstruction. I finished the repairs in time to race four weekends in late summer. I continue to race a Sunfish in the Frostbite series during the winter. In January, I hiked up the auto road on Mt. Washington to a viewpoint beyond the four-mile mark, elevation 4,200 feet. It took 5.5 hours for the roundtrip during which the elevation change was 2,600 feet. Views were excellent, and a similar trip the next day to Tuckerman Ravine was equally rewarding.

Since leaving Fram (Facet) in 1978, I have been investing my monthly pension. Practice and avoiding the poor decisions of my early years have enabled me to improve to a reasonable return for the time spent on the portfolio.—**Marty Billett**, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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Please send news for this column to: **Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

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In celebration of the 500th anniversary of the discovery of America by Christopher Columbus, one of the major television stations in the Boston area has been saluting leading scientific figures of the last 50 years in New England. I am pleased to report that two members of the Class of 1950, **Robert Mann** and **Kenneth Olsen**, have been so honored with a short visual history on their accomplishments. As most of you know, they both started as occupants of the famous Building 22. . . . **Robert Snedeker** reports that he is now retired but is keeping busy with volunteer activities at the Boston Museum of Science. With permission, he also sits in on Friday afternoon seminars of Course X.

At the museum, Bob meets **Bob Murphy** quite regularly. Bill is VP of Operations at the museum and enjoys this challenging position.

Gerald Lesells reports that since retiring six years ago, he and his wife Jo have traveled full time with their trailer in the 48 contiguous states and 5 Canadian provinces. Besides the 55,000 miles of trailer hauling, they also did 65,000 miles with their unhitched pickup exploring byways. This experience, he reports, has been, in a very different way, an education comparable to the one he got at MIT. He is now planning on settling down, at least on a 50 percent basis, in Tucson, Ariz.

James McAllister and his wife Hilda are enjoying retirement. They returned in December from a 101-day voyage around the world on the S.S. *Universe*, taking a Semester-at-Sea with 420 college-age students and 38 senior adults. They visited 10 countries and learned plenty from the students, as well as the classes. Semester-at-Sea is sponsored by the University of Pittsburgh's Institute for Shipboard Education.

Richard (Bugs) Waldt writes that although he has many interesting things to keep him busy (such as his first grandchild, golf, tennis, wintering in the California desert, and cartooning—unpaid so far), the best of all is retirement from the current military-industrial environment of Long Island. . . . We are sorry to have to report the accidental death of **Frederic Grant** of Wellesley, Mass., who was struck by a car in Wellesley Hills Square early last year. Fred passed away near the end of 1991 in Youville Hospital. He had been a statistical engineer and a 36-year employee with Draper Laboratories.—**John T. McKenna**, secretary, P.O. Box 376, Cummaquid, MA 02637-0376



Over 200 MIT alumn/ae and friends gathered to greet Knut Kloster, '51 (above center), last September when a trio of Viking ships, which he sponsored with the World Watch Institute of Oslo, visited Boston. Among them were Marvin Grossman (left) and Bill Cavanaugh (right).

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For those of you who missed the item on the page following the Class of '51 notes in January 1992, I suggest you go back and read the interesting short feature on classmate **Knut Kloster** (page MIT 26). Knut sponsored—with the World Watch Institute of Oslo and New York—a trio of recreated Viking ships to draw world attention to environmental issues.

The article in the *Review* mentions a gathering of some 200 MIT alums when the ships visited Boston in September. Ginny and **Bill Cavanaugh** and Joanne and **Marvin Grossman** were among those who met Knut and his project manager, Harold Bjork, '49, on that special occasion. Visitors marvelled that one of the ships, the Gaia, a replica of a Viking Longship from 850 AD, had just crossed the north Atlantic from Bergen, Norway, without mishap.

In a moving speech to alumni/ae and friends, Knut explained that "when Gaia's sail goes down in port, up goes a pennant with her mission statement: 'A thousand years ago. . . Europe and America were brought together by the Vikings. . . Since then, our knowledge of the world has grown faster than our sense to take care of it. Now we must set the right course ahead and open up a new era.'"

The ships are next headed to Newport, R.I., and Washington, D.C., and they are scheduled to be in Rio de Janeiro in June for the UN Conference on Environment and Development, referred to as the "Earth Summit."

Named vice-chair of United Water Resources, **George M. Haskew, Jr.**, remains president of President-Spring Valley Water Co. . . . The Knight Foundation, one of the nation's largest foundations, makes grants in journalism, higher education, and the field of arts and culture. It is the principal sponsor of the Knight Science Journalism Fellowship program at MIT. Recently elected to its board, Dr. W. Gerald Austen, chief of surgical services at Massachusetts General Hospital, is an internationally recognized heart surgeon and is a life member of the MIT Corporation.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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40th Reunion

Yaichi Ayukawa, a life member of the MIT Corporation, died last November 30. He received a BS in industrial microbiology from Tokyo Imperial Univ. in 1945; then from MIT, an SB in chemistry and an SM and PhD in food technology and industrial management. He had a distinguished career in business in Japan, and had served on several visiting committees to various MIT departments as well as the MIT Corporation. He has been described as MIT's major contact in Japan. He is survived by his wife, Masako, and a son. . . . **Paul C. Watson** died last December 25. He worked as a foreign service officer in Vienna and for Baird-Atomic before joining the MIT Instrumentation Laboratory, now the Charles Stark Draper Laboratory, from which he retired in the late 1970s. He is survived by his wife, Phyllis, and two sons.

Robert Ehrlert says he retired two years ago from TRW where he had been director of transition management after many years as director of business planning for TRW's aircraft component business. He is enjoying retirement, his two grandchildren, dabbling in painting and PCs, and playing volleyball. He attends local MIT alumni events in Ohio and has visited several Elderhostels with his wife, Phyl.

Phil Sperling and **Cliff Moon** apparently enjoy retirement so much they have done it twice. Phil says he "retired" for the second time from the same company, Coats & Clark, when it bought American Thread after he had left them and joined the latter. He is involved in several new ventures and is having fun. Cliff says he retired for the second time and spent last summer sailing Long Island Sound. Both Phil and Cliff are looking forward to our 40th Reunion. . . . **Charles Saltsman** writes that his third son, Tom, graduated last June from Harvard Graduate School of Design, married another architect, and now both are on assignment in Barbados. He thinks that is not bad for starters.

I felt a flash of alarm when I saw that **Dana Mayo** had written, "I became Charles Weston Pickard. . ." I relaxed when he went on, ". . . Research Professor of Chemistry this year at Bowdoin College." I think it is "Pickard" into whom he was transformed. His handwriting leaves room for interpretation. Dana has had a very distinguished career teaching chemistry at Bowdoin.

Joseph Alibrandi, after serving three terms as chairman of the California Business Roundtable's education committee, has decided that public schools require competition to improve. He is working with a group sponsoring a proposed ballot initiative that would result in state money going to whatever school a child attended, public or private, so that everyone could afford to choose his child's school. The matter is controversial, to say the least.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301

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When this edition of the notes reaches you, it will be just about a year from our 40th Reunion. I hope a large number of you are planning to attend and have already put a wedge in your calendars for June '93. I'm looking forward to seeing those of you I haven't seen in years. I am well aware that we may not be able to recognize each other, but I'll arrange to wear something distinctive in my buttonhole. I'd appreciate a note from any of you who plan to attend. I'm going to start a list of attendees and I'll publish it a couple of months before the reunion.

I received a note from **Ben Coe** who reports he is slated to become the president of the Jefferson County (Watertown, N.Y.) United Way in January 1992. He remains the executive director of the New York State Tug Hill Commission. The Commission assists 41 towns and 21 villages in land use planning and community development. Ben has been active, in the past two years, singing in choir and charity events. He has chaired a committee that

established a Volunteer Center in the County in 1991 under the United Way. The Center received a \$20,000 national start-up grant.

Richard Storey reports from Vista, Calif., that he has been active as a volunteer literacy tutor. He has also been a volunteer in the California Health Insurance Counseling and Advocacy Program. He is the first one on my list of those planning to attend the reunion.

John Morgenstern is still living in McLean, Va. He is president of JCM Associates, Ltd., a systems consulting firm specializing in command, control, and communications systems, management information systems, and communication systems. John also co-founded computer rental/leasing companies in Virginia and Massachusetts. He and his wife of 37 years, Barbara, have five grandchildren. One of their three sons lives in Wellesley, Mass., and operates real estate offices in Wayland and Lincoln. The second lives in northern Virginia and operates a computer leasing company. The third is a teacher in Eugene, Ore.

Alan Lampke, who lives in Greenwich, Conn., is involved, on a volunteer basis, in the design and rehabilitation of a half-way house and residential apartments for the mentally handicapped in the New Haven, Conn., area. . . . **Jack Walsh** retired from York International Corp. as senior VP on January 1, 1990. He has a small consulting practice in York, Pa. He spends about one-third of the year on his farm and does a lot of fox hunting in southern York County. He and his wife have one grandchild and two more on the way. . . . **Albert B. Reynolds** was appointed in July 1991 to chair the Department of Nuclear Engineering and Engineering Physics of the University of Virginia.

David W. Cravens, the holder of the Eunice and James L. West Chair of American Enterprise Studies at Texas Christian University, has received the Chancellor's Award for Distinguished Research and Creative Activity for 1991. The honor includes a check for \$12,000 in recognition of outstanding ability and accomplishment, to cover expenses the awardee feels will most enhance his contributions as a scholar. David was a distinguished visiting scholar at Australia's Monash University in 1989.

David is internationally recognized for his studies in marketing. He is co-author of *Strategic Marketing*, recently issued in its third edition, which has both Taiwan and Asian editions. He is also co-author of *Marketing Management*, published in 1987. David is active in the American Marketing Association, Academy of Marketing Science, and Institute for Management Science.

That is enough for this edition. Remember to send me a little note to let me know if you are going to attend the reunion and I'll add your name to the list to be published later.—**Gilbert D. Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

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Please send news for this column to: **Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Lane, Fairfield, CT 06430

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Frank Perkins, Dean of the MIT Graduate School, has been elected VP and president-elect of the Association of Graduate Schools, an institution that is part of the Association of American Universities. He will be VP until October 1992, and then will serve a one-year term as president of AGS, which provides a forum for the exchange of information on doctoral education for its 58 graduate school dean members. Frank is noted for applying computers to problems in hydrology and civil engineering.

The seasonal news letters for 1991 informed us that **Ed Ehrlich** is the only member of his family that did not move, finish school, change jobs, or get married last year. Ed continues at Tufts-New England Medical Center, and is spending a lot of

time working with the Boston Chinese Community and the MIT Alumni/ae Association. His wife, Jan, graduated from the BS nursing program that she had been enrolled in for eight years, and is continuing to work as a staff nurse in telemetry at Framingham Union Hospital. Ed and Jan did a lot of traveling in 1991. With youngsters in Greenville, N.C., New York City, Philadelphia, Santa Barbara, Atlanta, and Dallas, we suspect they will do the same again in 1992. However, they did celebrate Jan's graduation with a two and a half week trip to Hawaii and San Francisco last year. We are waiting to hear what their 1992 special will be!

Harlan Walker reports that he still has chronic fatigue syndrome, diabetes, high blood pressure, and hemochromatosis, which is a retention of organic iron compounds in the body and which is being treated by phlebotomy (blood letting) once a week. . . . **David Peterson** continues to operate his two-man consulting business in the Minneapolis area. They have been specializing in construction, facilities record management, and CAD for industrial and public utility organizations since 1981.—Co-secretaries: **Roy M. Salzman**, 481 Curve St., Carlisle, MA 01741; **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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Paul Abrahams has published his second book through Addison-Wesley, *UNIX for the Impatient*. Paul is a consulting computer scientist and writer in Deerfield, Mass., specializing in programming language, software design and implementation, and technical writing. Paul's first book, *TEX for the Impatient*, was published in 1990. He is a past president (1986-88) of the Association for Computing Machinery (ACM). Paul enjoys living in the country and his life as an independent consultant. . . . **Robert Follett** is the program director of standards at the IBM Corp. In October 1991, he became the chairman of Subcommittee 22, Languages, of ISO/IEC Joint Technical Committee 1 on Information Technology. SC22 is the international subcommittee responsible for standardization of programming languages and their environments, which includes the POSIX family of standards as well as all major computer programming languages. Bob has been with IBM for 31 years.

On October 19, 1991, Course 16 had a mini-reunion dinner party at the home of Joan and David Mitchell in Lawndale, Calif., with **Fred Culick**, **Charles Hoult**, **Robert MacDonald, Jr.**, **Haig Parechian**, **Gerald Sozio**, **Robert Stapleford**, and their wives. The next annual reunion dinner will be October 17, 1992, and other classmates are welcome. Contact the above in the Los Angeles area if you can attend.

Ronald Massa is president of the Lorrin Corp. in Burlington, Mass. The company develops and sells bomb and fire defense technology and software, such as BombCAD and FireCAD. Ron previously had founded Dynatrend, Inc., in 1971 and was the CEO until 1983 when it became a part of EG&G as EG&G Dynatrend. Ron has written many professional papers and was class president these past five years. He lives in Bedford, Mass., with wife Lorraine, daughter Diane, and sons Ronald, Robert, and Christofer. Ron enjoys skiing, boating, and travel.

William Northfield is president of Celltel Systems, Inc., in Arlington, Mass. Bill has been an entrepreneur involved with small companies for a number of years. Among his interests are international business, information systems, and human behavior in the social/political environment. Bill resides in Lincoln, N.H., with his wife, Sandra. His daughters, Christy and Wendy, are married; Christy has two children and Wendy is an architect in Boulder, Colo.; Bill Jr. is earning an MBA at the London School of Economics in the U.K. Bill enjoys reading, sailing, skiing, tennis, hiking, and travel. Send news to **Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02161, (617) 332-2622

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35th Reunion

This is a rather light month for news. Professor **Larry Young**, of the Department of Aeronautics and Astronautics, director of the Man-Vehicle Laboratory, is among the seven finalists NASA is considering as payload specialists for a 1993 Spacelab flight. The finalists were selected by the principal investigators of the experiments that will be aboard SLS-2. This is a vote of confidence by his fellow experimenters, but it also may give Larry an opportunity to experience first hand a phenomenon he has been studying for 13 years—space motion sickness.

Philip Presser writes from Long Beach, Calif., that he was married in July 1990 and retired in February 1992. He has spent a lot of time traveling, including pedaling and hiking in France, Switzerland, and Italy. He also reports that he loved Turkey and Japan.

Bill Bateman writes that after 31 years he is still working in South Africa. For the last 25 years he has been in charge of the company his grandfather founded. He writes about the current political developments with guarded optimism. He also reports that he has been married for 30 years, has three daughters and two granddaughters, but has nobody to carry on the Bateman engineering tradition.—**John T. Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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Spring always seems to bring signs of new beginnings for many of our classmates. For example, **Mac Jordan** writes, "After nearly five years at the University of California—Berkeley, I officially entered retirement in July 1991. Following a career that has included 26 years in the oil business and five years in continuing education, it's on to the next stage. Mary and I have lots to do together. We are taking college-level courses including computer operations and opera appreciation. We continue to travel to visit children and grandchildren. Best of all, we have time to enjoy the many wonders of northern California."

John Holmfeld has been appointed executive director of the Council of Scientific Society Presidents, an organization of the presidents of 58 U.S. scientific societies. For the past 20 years, John has served as a professional staff member with the Committee on Science, Space, and Technology in the Congress. Because the combined membership of the member societies is over one million scientists and mathematicians, the CSSP represents a strong voice in support of science and science education at the national level.

Hugh Murphy has been named vice-president of power generation, customer service at General Electric Industrial and Power Systems. Previously, Hugh served as general manager at this facility in Schenectady. . . . Another installment in the adventures of **Bernie Schneiderman in Hawaii**. Bernie writes, "Just returned from three weeks of trekking in Bhutan. Adventure of a lifetime."

Given the general state of the economy, it was wonderful to receive a letter with such good news from **Toby Carlson**. He writes, "This past year has been a banner year in which everything I have been working and hoping for seemed to fall into place. My first book, *Mid-Latitude Weather Systems*, was published by Chapman and Hall. This was followed by a recording of folk music, *Simple Gifts*. Then, to cap it off, we had a great bike trip through eastern Maine and the Canadian Maritime provinces. I'm enlarging my horizons in my role of professor of meteorology at Penn State by incorporating ideas on plant physiology and weather. Currently, I'm planning a French Quebec bike ride staying at farmhouses in southern Quebec this spring. Anyone interested in joining me?" For those with the interest and conditioning, Toby can be reached at Penn State in State College, Pa.

Nancy and I have made the move to Connecticut,

and we're renting a condominium temporarily while we continue to look for a house. So, change those address books once again!—**Mike Brose**, secretary, 1298 Hartford Tpke., #1-L, North Haven, CT 06473

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The mailbag was a little thin since the last notes and this is an invitation to all to drop me a line. . . . Congratulations to **Fred Wan**, who received the Arthur Beaumont Distinguished Service Award of the Canadian Applied Mathematics Society last year. The Society's newsletter provided an excellent review of Fred's history from the halls of the Institute as a student and faculty member in mathematics to being the first director of the Institute for applied mathematics and statistics at the University of British Columbia, then on to the University of Washington as head of its department of applied mathematics and subsequently to associate dean for the sciences in the College of Arts and Sciences. Fred's wife Julia is also actively engaged as the assistant superintendent of the Bainbridge Island School District.

Bruce Blomstrom has relocated as president of CliniShare in Chatsworth, Calif. Bruce notes that CliniShare's activities are primarily in the Los Angeles area, where he supervises 700 professionals in 10 facilities. They provide pre- and post-hospital services as part of the broad spectrum of health services provided by UniHealth America. . . . **Malulee and Adul Pinsuvana** provided a new year's update from Bangkok. They returned to Thailand from his assignment with ASEAN in Indonesia. Adul is now the president of Siam Food Products Co., Limited, a producer and canner of pineapple and related products. The active Pinsuvana family includes Argard, who is following his father's path as an officer in the Royal Thai Air Force; Aswin, who graduated with a master's degree in engineering from Northeastern; Lalida, who is married and living in Los Angeles; and Anond (Niki), who is in the fifth grade. Malulee maintains her active pace writing cookbooks, organizing an Indonesian Food Festival in Bangkok, and putting on a Thai cooking program in Santa Barbara. Adul not only closes with his standard invitation to visit, including the availability of the extra bedroom, but has also provided his fax at 66-2-3198469 for those who want to make direct contact.

I recently had breakfast with **Arthur Collias**, who shared the excitement of the success and prospects for Mitek Surgical. Arthur is also taking on leadership roles with his church and other charitable organizations. . . . Our class president, **David Packer**, is already thinking about our 35th in 1994! Boston-area officers will be convening soon to outline some thoughts for the next reunion. . . . In addition to the mail, we can also receive your fax notes at 617-258-6676!—**Allan S. Bufferd**, secretary, Office of the Treasurer, MIT 238 Main St., Suite 200, Cambridge, MA 02142

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A recent issue of *Tech Talk* tells about our first Class of 1960 Fellow, Professor Arthur Steinberg. Professor Steinberg received an AB from Harvard in 1958 and a PhD in classical archaeology from the Univ. of Pennsylvania in 1966. He joined the MIT faculty in 1969. His early research involved ancient metallurgy in Cyprus and Turkey, and recently he has been studying the development of oil painting, especially in Venice. Adjunct to his work in the Integrated Studies Program—for which our fellowship was directed—Professor Steinberg has developed ISP-like curricula for the Cambridge and Quincy, Mass., school systems and has worked with school systems in Chicago and San Francisco.

Larry Elman recently provided me a copy of a letter he had sent to the curator of the MIT Museum, commenting on the book, *The Journal of the Institute for Hacks, Tomfoolery, & Pranks at MIT*. (I,

too, have read and enjoyed the book.) In his letter, Larry recounts some of the "hacks" he perpetrated, his favorite being when he hung a sign "Abandon Hope All Ye Who Enter Here" over the freshman registration desk in Building 10. Larry says that he was aided in the prank by a grad student who supplied a key allowing him to get through a locked door in Bldg. 10. He was apprehended by a security guard, but he had forged on MIT stationery a note from the Dean of Students (John Rule) that the plot was an authorized Voodoo prank. Larry says the 30-foot sign remained hanging for about two weeks apparently because B&P had it logged-in as an authorized sign.

Larry has a few more "hacks" in his letter and closes with the wish that others come "forward with stories of what makes Tech one hell of a place to be." Any other "hackers" with stories (confessions) to tell?

I have a note from **George Pillorge** who says that he plans to retire in July 1992, and that he is "looking forward to the next quarter century of freedom." Best wishes for more than a quarter century, George!

As I write this in early February, I have in hand the year-end-1991 report from the Alumni Fund. We are on the path to an even more generous year than last; so far 185 (26 percent) of us have given over \$138,000. Many thanks from your class agent for making his job so easy.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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Some of us keep being associated with the front page. For example the papers recently reported the Department of Energy has decided to suspend manufacturing plutonium weapon triggers at the EG&G Rocky Flats plant outside of Denver. Well, this affects **Herb Berman**, who works there. He came to Rocky Flats in July 1990 to establish a Systems Engineering Group. Some of you may remember that in 1990 DOE had taken management responsibilities away from Rockwell, because of enormous safety concerns, and given them to EG&G. That's when Herb was hired. By spring 1991, he was promoted to director of plant engineering. Last summer he moved up and became assistant general manager for engineering. The work must be difficult. When I visited in the summer of 1990, the safety problems were very severe, and the White House was insisting that production be started immediately (despite the Soviet Union's disintegration). The Berman's live in Golden with a five-year old Rhodesian Ridgeback lion hound. The family otherwise consists of Herb, wife Lelanda Lee, and Cecelia (6). After more than 17 years working for the Navy in Pearl Harbor, this has been quite a change for the Berman's.

Speaking of the White House, it isn't every MIT class that has a famous member featured prominently, if not positively, in Pogo. **John Sununu** is keeping a stiff upper lip and looking forward to a less prominent life in New England.

John Savage, professor of computer science at Brown University, comes up the 'toot occasionally as a member of our Visiting Committee for EECS. Congratulations, John. . . **Gerry Wilson** is VP for corporate technology at Carrier Corp., in Farmington, Conn. He's still on extended leave from MIT.

Ken Kotovsky wrote, "Things are great in Pittsburgh! My family had a wonderful time celebrating our daughter's wedding last summer. She and her husband are finishing doctorates at the University of Illinois in psychology and computer science, respectively. Laura is MIT (Course 9), '87, and Ran is out of Harvard (math), '87. (He is very nice, so we try not to talk about his poor choice of undergraduate institutions). Laura's brother Jack, '90, is still at the Institute in graduate school in Course 2. He also does standup and improvisational comedy around the Institute as a member of the Road-Kill Buffet. Avis and I have both changed jobs in the past few years. She is

director of the In-Home Program at Pressley Ridge Schools, where she and her talented crew work with families in all kinds of supportive ways to prevent their having to institutionalize their children. I've moved to a great department at Carnegie Mellon as associate professor of psychology and director of the undergraduate psychology program. The dog is still a pain in the ass (although a lot older than when I last wrote—as we all are—I think it might be monotonous with time)." Thanks for the wonderful letter, Ken!—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

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30th Reunion

Our 30th Reunion begins Thursday, June 4, with Tech Night at the Pops, and our class will have a reception before the pre-Pops dinner. Friday, June 5, is Technology Day, with the theme, "How Can American Organizations Excel in the 21st Century?" With all of the controversy over American workers and corporations fueled by the publicity surrounding President Bush's trip to Japan with the Motor City Moguls, this topic will certainly be timely. (The following is offered in the editorial spirit of wry humor: We expect you to come waving patriotic banners and driving "Made in America" vehicles such as Nissans from Tennessee or Toyotas from Kentucky. Clothing will be checked for American origin labels. Classmates from other countries will be welcome as long as they can show they have purchased American-made products within the last six months to help pull the U.S. economy out of the recession.) Friday night features a class dinner with **Dave Stare's** classic vintages from Sonoma County, Calif.

Saturday's program includes discussions on K-12 education in the U.S. with prominent speakers from education, business, and government; the third annual "Techsas" barbecue and alumni/ae games; living group get-togethers; and a dinner-dance at some picturesque Boston location. The concluding event will be a Sunday, June 7, brunch at the Charles Hotel in Harvard Square. Sure hope to see you there. If you haven't signed up, it's not too late. Contact Chris Foglia, (617) 253-8232 to register (deadline May 20). If you haven't sent in your class dues of \$30, please do so ASAP, since there will be some economic advantages and premiums provided for all dues-paying members.

News from classmates includes ASME fellow honors for **E. Bjorn Qvale**, professor of energetics at the Technical University of Denmark, Lyngby. Bjorn has achieved international recognition for his research on water-driven pumps and systems for pulverized coal-handling, aquifer thermal energy storage, and energy efficiency in refrigeration and air conditioning equipment in city buses. His thesis on the harmonic analysis of Stirling cycles established a new direction in the practical design analysis of these cycles. Qvale is the author or co-author of more than 100 technical publications and has been a member of ASME since 1964.

Dave Stare made a splash in Wellesley when he returned to his hometown in January 1992, to hold a wine-tasting party at the Wellesley Inn. Dry Creek Vineyard vintages will also be featured at our class reunion events in case you missed the party in Wellesley. Dave has also visited Newton and other locations in the Boston area promoting his wines from California. "Wine tastings are a good way for people with a casual interest to learn something about a fun subject, enjoy a good meal, and meet new people," says Dave.

Thomas P. Sheehan writes that he is working for Argonne National Laboratory in the field of high temperature superconductivity and is writing a book on applications of superconductivity in industry. Tom traveled to the Soviet Union in the summer of 1991 prior to the coup, and really enjoyed his stay because of his daughter's skill in the Russian Language. . . . A note from **LeCharon** (formerly J. L. duCharme) informs me that his aunt, Flore duCharme, now Sister Mary Ignatius of the Sisters of Providence of Montreal and now retired in Spokane, Wash., recently celebrated her 103rd

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birthday. . . Lieutenant Commander **Donald W. Horner** writes that his new assignments at ERIM (Environmental Research Institute of Michigan) include: program manager for an Advanced Target Recognition Processor and head of the Advanced Electronic Packaging Technology Department, which is engaged in multi-chip module development.

Charles D. Anderson recently joined Alliance Pharmaceutical Corp. at their Otisville, N.Y., location as director of operations and engineering. . . **Francisco J. Cuervo** is presently director of quality management, Polychrome Americas, in Clark, N.J. His firm manufactures photographic film for the graphic arts. . . **Modesto "Mitch" Maidique**, president of Florida International University, was featured in a recent issue of the *Miami Herald*, detailing the great job he has been doing at FIU raising money and bringing in academic talent. Under his leadership, FIU enrollment has grown from 16,000 to 23,000; it has seen its budget increase from \$99 million to \$150 million, research funding grew from \$6.2 million to \$13.5 million, and there has been \$80 million in new construction. All this occurred during a period when state funding was being trimmed by \$12 million. Mitch still hopes to turn FIU into a nationally recognized "powerhouse" by the end of this decade.

Dave Carey of Naperville, Ill., replied to my question concerning "Medical Records Week" in a previous column. He tells me it is to recognize those hard-working professionals who "take the mumbly, gum chewing, and belching that medical doctors leave on the recording equipment and translate these sounds into intelligible English." Dave's wife, who works with medical records, also mentioned that "all hospital departments have weeks of national recognition."

Classmates, please drop me an informative line or even a critical comment whenever you have the opportunity. Some news is always better than no news, but do try to maintain a sense of humor. Life is too short to take serious offense at words offered up during my lighter and happier moments.—**Hank McCarl**, secretary, P. O. Box 352, Birmingham, AL 35201-0352

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It's time for my annual freak-the-editor column. It's not my fault—it just happens when I don't get much news. I get this compulsive urge to write politics, so I'm going to offer my recommendations for whichever party wants to take them. For President: Cal Ripken, Jr. He had a helluva better year than any politician, much better numbers. (Of course, as a Baltimorean I admit I'm partial.) For vice-president: Boris Yeltsin. I know he's busy in Russia, but someone else can preside over the Senate in his absence. He's a savvy politician, and his Russian would be no less comprehensible than the English from some of our current officials. Of course, if any of you have declared for any political office, let me know and I'll give you some free publicity.

Now the news. **Henry Nau** is looking forward to a sabbatical this summer—he'll be starting a new book. Have you gotten a copy of his book, *The Myth of America's Decline*? (Maybe he should be running for president!) . . . **Fran Dyro**, M.D., is director of the clinical neurophysiology lab at the V.A. Center in West Roxbury, Mass. She's also on the neurophys staff at Brigham and Women's Hospital. She lives in Portland, Maine—what a commute. Like many of us, Fran has a wish for another career. "I dream of one day quitting all this to write murder mysteries!" Move to Cabot Cove, Fran, and go for it!

Speaking as we were of high office, **Don Fraser**—according to a clipping I got—is Deputy Under-Secretary of Defense for Acquisition. With the defense budget cuts, that should be quite a challenge. Don was formerly executive VP of the Draper Lab, and lately a deputy director in a DOD office.

Now I know you all have stuff to tell us, so get

with the program. Communicate!—**Phil Marcus**, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (410) 750-0184, CompuServe 72047.333, Internet: 72047.333@compuserve.com.

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All kinds of items this issue—an e-mail message, a letter, a couple of phone calls, and a Fund note from the Alumni/ae Association.

Mark Joseph responded to the e-mail address I provided several columns ago with a message from his office at Mitre. He noted that he probably has renewed the distinction he earned at our 25th reunion of having the youngest offspring in the class. His son, Noah, celebrated his first birthday last December. Ethan, the reunion prize winner, just turned three. The two of them are keeping Mark and Deborah quite busy "but are in any case a joy." Is there anyone in the class who has a younger child than Mark's new son?

Guilt from not having sent in news for almost five years motivated **Lita (Donnelly) Nelsen** to write. She reports: "I'm still working in the Technology Licensing Office of MIT, now as associate director. Most of my own licensing work is in the biotechnology and chemical fields, although the office in general (now one of the most active university licensing offices in the country) works in all the fields in which MIT does research. In addition to conventional licensing, I've also been involved in a number of biotech start-ups. It's fun and satisfying being a 'godmother' and watching these embryonic companies grow."

"I'm also president-elect of the Association of University Technology Managers (will be president starting in February 1992), so I'm able to watch the development of university technology licensing across the country. It's growing fast."

"My daughter, Katrina, graduated from MIT last June. The graduation ceremonies are just as long and boring as ever! She was a Course IX major and has now begun a five-year program leading to an MS in health science and an MD from Berkeley and UC/San Francisco Medical School. My son Dan, has started college in mechanical engineering at RIT. Don and I still live in Winchester. We're afraid to move after accumulating 22 years of junk in the house. . . Best to the class!" . . . Thanks, Lita!

I got a call from **Bill O'Halloran** when the *Boston Globe* featured my wife, Louise, in a story on Harvard Business School MBA graduates who don't have undergraduate degrees. We traded media mentions (I had just gotten two paragraphs worth of "ink" in the December issue of *Self* magazine); Bill and several of his colleagues from Synetics were featured in the January 1992 issue of *World Trade*. Included is a delightful story of how Bill's brass rat earned him some leverage with a Nigerian businessman (and fellow MIT alum) while Bill was on a marketing trip to Africa. Bill and Gretchen continue to live in Reading, Mass.; sons Jeff and Brian are in their senior and sophomore years of college, respectively.

I continue a frequent professional dialogue with **Gary Walpert**; he (with the rest of Hale & Dorr) is representing us (the Foundation for Informed Medical Decision Making) as we pursue a licensing agreement for our interactive video programs with a major electronics manufacturer. On the personal side, Gary reports that all is well at the Walpert house. Oldest daughter Tara is enjoying her first year at Harvard; younger daughters Ellen and Kirsten are responding well to moving up one notch in the pecking order; son Eric is doing well while closing in on the "terrible 2s" and all of the above is keeping wife Ellen busy.

An Alumni/ae Fund note from **Lester Hendrickson** in Brussels brought the information that he is president of CBIS Europe, which is involved with software and systems integration for the telecommunications industry. As Europe comes closer to economic integration, changes in the telecommunications industry must be getting quite exciting.

It was fun having a bunch of things to write

about. Make my day; send your own news item. Thanks.—**Joe Kasper**, secretary, RR 2, Box 4, Norwich, VT 05055

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Frank Mechura reports from Toronto that he has become president of Crown Cork's Canadian operations. Crown Cork has 13 plants in Canada and does over \$500 million in business. He sounds excited about being back in a direct operating role.

John Murray was recently appointed divisional editor of the journal *Applied Optics*. His section deals with lasers, photonics, and environmental optics (including remote sensing from space). He asks those in the field to send him a note if you have anything to publish! John is a laser physicist at Lawrence Livermore and has spent much of his career working on laser fusion. He and his wife, Gwyn, have a younger family than ours, David (8) and Catherine (6).

At the other end of the age spectrum for children, **Steve Duerr** reports that his oldest is married and living in Virginia while her husband is completing a PhD, his second is living here in Boston, and his third graduates this spring. Like Marie and me, Steve and Judy were married before graduation. Steve has lived in New Jersey since the late 1970s, and is now running his own company, Metuchen Analytical, Inc. Metuchen is a specialized laboratory that performs analyses for industries that lack in-house capability. His current work is in the cosmetics and pharmaceuticals area. Steve and his wife Judy spend their weekends and summers at their beach house in Delaware, noting, "It's a nicer shore than New Jersey, and we inherited a wonderful home from my family."

Pierre Perrolle is completing his first year as assistant director of the White House Office of Science and Technology Policy. Pierre has been in Washington since the late 1970s, initially as a China expert with the National Academy of Sciences, and subsequently at the NSF. He spent two years as science counselor in Beijing and has expanded his area of focus to the erstwhile Communist countries. At OSTP he is concentrating on international affairs and policy, with particular interest in the human dimensions of global change. His daughter Jeanette recently graduated from Brown.

Write or call.—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167, (617) 890-5771

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I was pleasantly surprised to find an article in our local newspaper by **Damian Kulash**, "We don't have to live with potholes." (Obviously, he does not live in Buffalo.) He is in Washington as executive director of the Strategic Highway Research Program of the National Research Council. Let's hope the advances he cites in asphalt chemistry can be quickly utilized. . . . **Richard Cockerill** is also in Washington hoping to survive in a downsizing Navy Department. He is currently with the Space and Naval Warfare Systems Command. . . . **Stanley Horowitz** is assistant division director of the Institute for Defense Analysis. His wife is also an economist, but at OMB. He has two sons, 9 and 12, and would like to hear from MIT classmates when they are in the D.C. area.

Craig Fields is now president of Microelectronics and Computer Technology Corp. in Austin, Tex. . . . **Peter Young** and his wife, Ellen, just celebrated their 25th wedding anniversary. Their son Paul already graduated from Hampshire College and son John is a senior at Whittier. . . . **Robert W. Poole** is president of the Reason Foundation, a California-based group that promotes the privatization of functions once thought to be solely the responsibility of government. The foundation is an outgrowth of *Reason* magazine, which he founded way back in 1968.

I talked to **Judy Risinger Perolle**, one of the missing coeds from the 25th Reunion. She did have

a good excuse: she was in Czechoslovakia. Judy is a professor at Northeastern in the Sociology and Anthropology Department. She just took advantage of the falling real estate prices in New England and bought a place of her very own right in Cambridge.

You have been spared "cat tales" for this month. thanks for the notes.—**Eleanore Klepser**, secretary, 84 Northledge Dr., Snyder, NY 14226-4056

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25th Reunion

This will be our last reminder to attend our 25th Reunion at MIT June 4-7. It's not too late to sign up. Charlotte and I look forward to renewing friendships and making new ones at the reunion. Do attend. On another subject, we can use your help in identifying current addresses for some of our classmates. From time to time we plan to list in this column the names of some classmates for whom we do not have current addresses. The names for this month are **Muayyad Al-Khudairi**, **Ken Barbour**, **Bob Bosler**, **Mike Comer**, **Jairo Echeverri**, **John Forster**, **Bruce Greenwald**, **Maximilian Iacono**, **Steve Kuyamjian**, **Nathaniel London**, **Bill Parkyn, Jr.**, **Richard Ribak**, **Henry Seldon**, **Barry Starr**, **Ted Warren**, and **Horace Yuen**. We would appreciate hearing from you if you know the current whereabouts of any of these classmates.

Heidi and Pete Amstutz and their two children (10 and 8) are enjoying life back in America. Last year was mainly occupied with the building of their new home in Dayton, Ohio, where Pete is assistant treasurer at NCR. The acquisition of NCR by AT&T has provided a unique opportunity for Pete to observe the dynamics of takeover, technology, and finance at work simultaneously. . . . **Steve Metz** retired from the U.S. Navy in January and has accepted a faculty position in the Department of OB/GYN at Baystate Medical Center in Springfield, Mass. He arrived from California just in time to experience a big icy rain storm, just Massachusetts' way of saying "Welcome Back" . . . **Dianne Pickering** spent the 1990-91 school year back in school full-time, this time as both a female and civilian minority student at the Naval War College in Newport, R.I. She received an MA in national defense and strategic studies and an MA in international relations, the latter degree from Salve Regina College. Dianne wound up the school year by getting married to the man she had left behind in Maryland when she was in school there. That's a great year!

Roy Gamse is now senior VP of customer service for MCI Telecommunications in Arlington, Va. His wife, Joyce, is a docent at the National Gallery of Art and a substitute teacher at the school attended by their two children, Nicky (9) and Laura (7). . . . From 1977 to 1989, **Bob Domnitz** ran Technical Collaborative, a contract electrical engineering firm. During that period he became progressively more interested in the relationship of technology, law, and public policy, and, as a result, in 1989 he decided to close up shop and attend Boston College Law School. Bob will receive his law degree shortly and expects to work in an academic or government setting. . . . **John Patterson** was promoted to captain in the U.S. Navy in December 1989 and served briefly on Jerry Cann's staff in the fall of 1990, before returning to school at Ft. Belvoir, Va., in January 1991. He broke his neck in an auto accident in February, and now, fully recovered, he is program manager for Common Avionics at the Naval Air Systems Command in Arlington, Va. His kids (Ned in the 10th grade and Emily in the 7th) are growing rapidly and enjoy computers, Nintendo, and driving their parents crazy. Suzanne is kept busy patiently keeping everyone on track.

Ken Ogan is a principal scientist at Hitachi Instruments, Inc., working in analytical chemistry. . . . **Dan Hester** continues teaching in the Physical Sciences Department at Sacopee Valley High School in Hiram, Maine. The biggest news of last year was the growth of the Hester family—Dan's three daughters (Jann, Lisa, and Laura) welcomed to the family a new brother, Matthew, whom Dan adopted last May. Tighter school budgets and family

demands have caused Dan to drop some activities he advised at high school, but his enthusiasm for teaching remains high.—**Charlotte and Jim Swanson**, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024

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Just when you thought it was safe to go to the mailbox! This time of year is not a traditional one for talking fund raising, but it's not too soon to be thinking about our 25th Anniversary Reunion Gift. Our class has, over the years, shown a high level of participation in giving to the Institute (over 85 percent). Let's see if we can surpass that in the upcoming campaign. Start planning now for your contribution. More on the Reunion itself next month!

This apparently was the month for westerners to report in. **Peter Groot** reports that he is living in San Jose and continuing to work for CAE-Link on simulating radar images. He sings barbershop with the Garden City Chorus S.P.E.S.Q.S.A. I've always wanted to write that! From Gunnison, Colorado, **Howard Shaw** writes that "after working (playing?) in aerospace engineering for 12 years he has returned to teaching at Western State College of Colorado." Any old friends passing through south central Colorado are encouraged to look him up. He's in the phone book.

The Lufkin family, Ruth and I and our three boys, continue to live in Basking Ridge, N.J. Since the last year of the specialty prescription drug company I was with, I have been consulting, teaching entrepreneurship at Stevens Institute, and working to get another pharmaceutical company off the ground. Are there other classmates in the pharmaceutical industry? I'd enjoy hearing from you. Your ad hoc secretary, **Rick Lufkin**. Please continue to direct your correspondence to Mike and Gail's address.—**Gail and Mike Marcus**, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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Robert H. Dobson writes that in September 1991 he was elected president of the Conference of Consulting Actuaries. Two of his children have made it through college already—Frazier through Florida State University and Rob through the University of Virginia. "Three to go," he says.

Quite by chance, I managed to discover that one of us, **Lewis Flagg, III**, is in touch from time to time with actor **James Woods**. I wasn't imagining that Woods, Flagg, and Mallove were in an astro/seminar class together back in 1965. . . . On February 15 in Boulder, Colo., **James P. Kornberg** and his wife Sally celebrated the bat mitzvah of Jamie—the second of their three daughters.

I recently touched base with **Jeremy K. Raines** of Potomac, Md., who runs a top-notch electromagnetic analysis and design consulting company, Raines Engineering. Since 1972, Jerry has provided consulting services in electromagnetics—especially radiating and scattering systems. For Jerry and his four associates, 1991 was a banner year—impressive in view of most of the rest of the economy. . . . More class notes would be welcome. Please keep them coming.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Last summer **David Saar** started his own company, Saar Associates, Inc., to provide consulting and electronic product development services and to develop proprietary communications products. David lives in Lawrenceville, N.J., and would like to hear from classmates with similar interests. . . . **Charles Lieberman** tells us that our hopes for his continued employment at Manufacturers Hanover after its merger with Chemical Bank have been

realized. He has been named director of Financial Markets Research for the merged bank, with overall economic forecasting responsibility for all capital markets activities. Charles notes that he was cited in the year-end 1991 issue of *Business Week* as one of the few economists who correctly predicted that the recession would linger. At that time, he said, "I look forward to 1992 and hope that economic recovery will begin around mid-year." Due to publishing deadlines, readers may be able to tell how accurate Charles's prediction was.

Mark Snyder is living in central Massachusetts working on computer vision at UMass/Amherst, and trying to deal with state budget cuts. At the end of last year, his son Michael was 6 and his twin daughters, Kate and Elise, were 2. . . **David Asbell** writes, "Michele McNichols and I were married in April 1991 after a 10-year courtship. Our belated 'honeymoon' was an August kayak trip through the Grand Canyon (yes, again). I am still at Georgia Tech after all these years (16) and still working on an antenna test range at Ft. Huachuca, Ariz."

Joanne Cole and her husband Art, '68, are still living in Ann Arbor, Mich., where she is chief engineer for R&D for the Automotive Systems Group of Johnson Controls. Their daughter Gwendolyn graduated from college a year ago. Joanne says that she and Art play volleyball weekly with Rick Johnson, also '68, and his wife Cindy. . . In case you missed it, *Tech Talk* reported last year that **Joseph Cohen**, MIT professor of philosophy and political science, has been head of the board and principal editor of the *Boston Review*, a bi-weekly magazine devoted to literary, cultural, and political issues.

An MIT press release notified us that **Greg Jackson** has been appointed the first director of academic computing. The release describes Greg's duties as "the principal advocate for academic computing at the Institute. . . overseeing coordination of the delivery of academic computing services at the Institute." We think that means that Greg will be following through on Project Athena and expanding the use of Computing resources throughout the Institute. . . We are saddened to report that **John Litt** died last November of cancer. At the time he was a senior technical writer at Sun Microsystems.

Keep sending us your news!—**Greg and Karen Aronson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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Robert H. Price writes: "Connie and I have been married and living in Santa Fe, N.M. for nearly eight years. It's a pleasant place to live and things are going well for us. Connie's real estate business is doing very well, and I have recently taken on site management responsibility for JAYCOR's Albuquerque office, which is growing rapidly and hiring more staff. MIT graduates, BS or PhD in physics, nuclear engineering, or electrical engineering, would be welcome additions to the staff. On the sad side, our cat, Nippy, died last year at 24 years of age. She was with me nearly all my years at MIT."

Mitch Serota writes: "After 41 years of urban living, I've finally moved to the 'burbs (Glenview, Ill.). My wife, Barbara, daughter, Shelia (6), and son, Zachary (3) love it a lot more than I do. I spent too much time in the office as president of my own corporation. As an actuary, I specialize in employee benefit consulting for the 'middle market.' It's been a successful venture for the past four years. All I need now is to sell my beautiful condo in downtown Chicago. Any takers out there?"

It is my sad duty to announce the death of **John Chaiken**. John was born in Springfield, Mass. and obtained a BS in physics. He studied at MIT for a doctoral degree in geophysics, and for two periods he attended a Rabbinical School in Israel. He was a physicist/engineer in Boston from 1980 to 1984. He settled in Hebron in Israel's occupied West Bank in 1984 in an endeavor to obtain equal rights in the largely Arab city. In June 1987, he was stabbed in

the back by an Arab. He chased the man, caught, and subdued him. The Israel Defense Force determined that his attacker belonged to an Arab terrorist cell, and Chaiken was awarded a citation. At the time of John's death, he was attempting to adapt automated machinery for the woodworking industry in Hebron. He is survived by his wife, Marilyn; his parents, Arthur and Chaya Chaiken of Springfield, Mass.; five sons (Rafi, Mishel, Meir, Israel, and Shimon); two daughters, Tsip and Eliana; and a brother, Allen, in Phoenix, Ariz. . . Please send me your news.—**R. Hal Moorman**, secretary, Box 1808, Brenham, TX 77834-1808

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20th Reunion

Andy Moysenko has joined Semitest, Inc. in Billerica as manager of sensor technology. The firm is a relatively new manufacturer of semiconductor test equipment using advanced technologies. . . **Karl VanBibber** left the Stanford faculty in 1985 and joined the physics department at Lawrence Livermore. He is group leader for high energy physics. . . **Cynthia DuPont Tobias** was stage director for OperaDelaware's *Rigoletto*, which opened last November 30.

Steven Lerman has been appointed Class of 1922 professor of Civil Engineering at the Institute. He was the first director of Project Athena and is director of the Center for Educational Computing Initiatives and the Intelligent Engineering Systems Lab for Course I. . . **Peter Stoll** writes from Albuquerque that, "Like most people under Sandia Mountain, we have erosion problems when our annual nine inches of rain try to fall in 15 minutes. I tried to guide the water by digging shallow trenches and lining them with concrete paving blocks. But my faulty pickaxe technique damaged my knee, so I'm recovering from arthroscopic surgery. It's an amazing procedure!"

Hope to see you all at the Reunion. A packed schedule of roller skating and karaoke Friday night, talks on education Saturday morning, barbecue and field day events Saturday afternoon, Chinese banquet Saturday night, and brunch at the boathouse Sunday morning.—**Dick Fletcher**, secretary, 135 West St., Braintree, MA 02184

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It was good to get a letter from **Trip Barbar**, now a commander in the Navy. He is commanding the destroyer U.S.S. *Deyo*, based out of Charleston, S.C., after a six-month Mediterranean cruise. Trip regrets waiting 18 years to do what he joined NROTC to do, only to expect to be returned to the Pentagon and defense budget analysis when this task is completed. Wife Tina and daughters Lisa and Maria are enjoying "low-stress Charleston" after many years in the D.C. area.

Nicholas Hamisevicz reports that he and wife Anne Moran are the proud parents of a son, Gregory John in December. . . **Lee Perrin** is director of anesthesia at St. Elizabeth's Hospital in Boston and vice-president of the Mass. Society of Anesthesiologists. In his spare time, he is an avid Mac user and 4th Dimension developer.

Tom Lydon is a lead engineer for software metrics at Raytheon and is teaching software engineering economics at Fitchburg State. Tom challenges the rest of Theta Chi's "Lytramont" agglomeration (**Bill Billing**, **Wes Grandmont**, **Dennis Intravia**) to a golf match up in Norwood in May; they "have yet to beat me!" Gee, Tom, where were you when we of the Beavers' golf team needed you back in '72? Anyway, we hope that crew gets back together soon.

Not too much on the home front to report, just the travail of facing life at 41 and watching kids go off to college and depressing stuff like that. Regards to all the friends from our adjacent classes, and to the '73 bunch, facing the year up to our 20th (ulp!) Reunion—Write!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

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Classmates, Your Faithful Scribe of 13 years is beginning to have thoughts about not being Your Faithful Scribe past our 20th Reunion. Writing these notes has stopped being fun and has become instead one more thing I have to do. I know the next step along that path is low quality Class Notes. I'd like to serve as some other class officer and pass these writings on to someone who sees them, as I once did, as a creative challenge. As always, your thoughts are invited.

The mailbag was good this past month, with people making end-of-year Alumni Fund contributions and sending Christmas cards. **Ted Kochanski** writes, "Greetings to all from the Rockport Breakwater, approximately three kilometers out in the Rockport, Mass., harbor." Ted just completed a successful series of experiments dealing with the scattering of microwaves off the sea surface. The November winds were unseasonably warm and calm. He concludes: "I hope other classmates have fair winds for their sails in these troubled economic times." . . . It's a second child for Eileen and **Robert Elkin**. Mollie Shira, born October 8, joins 3-year-old Hannah Aviva. **Peter and Brenda Kurnik** sent a cute picture of their children Rebecca and Julia (Classes of '03 and '06, respectively). The kids are sporting baseball caps with famous initials, one of which stands for McChesney Interstate Transport, and the other for Missouri-Illinois Tractor. . . We close the short news section on yet another "up" note. This one from **Richard Sternberg**. His children, Marissa (4) and Jenna (3) are getting cuter by the day. Jenna can say "Institute." Richard hopes to end an eight-year hiatus and return to Boston for vacation and to see the Bruins.

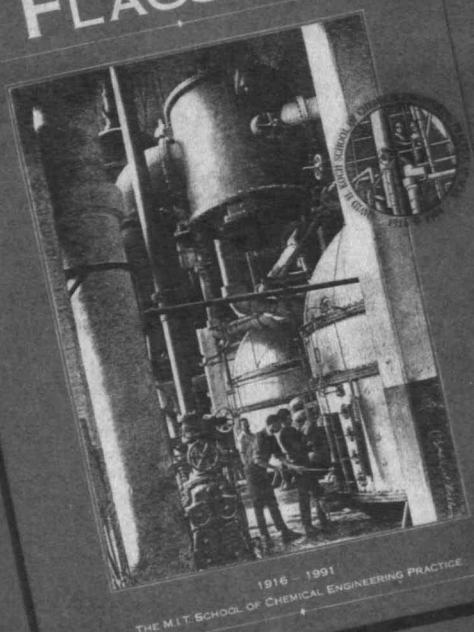
Know the phrase, "Do what you like, the money will follow?" Meet **Charlie Bruno**: "Quit the job I hated in July 1989 to fully pursue my two side businesses. Have been very busy with a structural engineering consulting firm (Bruno Engineering) and an automotive specialty shop (Charlie's Mustangs) hot rodding late model cars and trucks. I love what I do, don't answer to a jerk boss, or suffer or chafe under 'corporate culture.' Have met a very attractive and intelligent lady. Vacationed in Hawaii, first break in six years! Yes friends, stop being a corporate geek and become gainfully self-employed!" . . . **Tom Wolff's** Christmas letter was chock full of news about the kids, Marcy, and himself. We'll have to paraphrase. Living in the Lisle-Naperville (Chicago) area has been very good. Daughter Ilana is six, loves school, tumbling, swimming, and soccer. Son Joey is almost four, loves blocks, singing songs, and pre-school. Marcy has entered private practice in family medicine, joining with an established physician in Naperville. The practice is growing and she is thriving. Tom is on the board of directors of Congregation Beth Shalom. This year has been his best at Amoco. His group provides technical and business information to other parts of the company, and work he did was presented at a national meeting of the American Chemical Society (ACS), the Journal of the ACS, and two articles in *Database* magazine. He's also playing clarinet in the Elmhurst College Community Band. Whew!

As Dean Martin used to say (back when we were in elementary school!), "Keep those cards and letters coming in."—**Lionel Goulet**, secretary, 115 Albemarle Rd., Waltham, MA 02154-8133

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Just one item. **Kenneth S. Rumstay** had the following to say: "Not much new. The work of the Southeastern Association for Research in Astronomy is proceeding apace: construction on the telescope structure will begin in early 1992. The telescope site is on Mercedes Point on Kitt Peak, near the Case Western Schmidt Camera. Keep writing.—**Jennifer Gordon**, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

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From Neil Kaden: "Now our corporation's chief architect for PCS and Cellular Radio Standards & Planning. PCS is Personal Communications Services being able to make and receive telephone calls—wherever, whenever, and most importantly, however you want to. Definitely the *hot* area in telecommunications for the mid-90s." ... Steve McConnell writes: "I don't have much news since I've been doing the same job at the same place for eight years now. Is this a rut forming? Once recent change: carpal tunnel syndrome has kept me away from computers (and the French horn, alas) for the last three months." ... Daniel Christman enjoyed seeing friends and the Tute at our 15th Reunion last June. Got engaged in August and broke it off in September. Painful, but better than after the wedding." ... Joel Kulp, '75 "finally gave up on bachelorhood and got married this past year! My wife Mary is a farm girl from Kansas, works in nursing, and shares my faith and involvement in church activities. Also this past year, I celebrated my 15-year anniversary with Motorola (my previous marriage!), where I'm an engineering section manager in the Radio Telephone Systems Group in Ft. Worth." ... Patricia and Elliot Chartash wish to announce the birth of their first son Zachary on December 4. ... Your secretary had a delightful surprise just before these notes were due. While attending a trade show in Manhattan, I ran into Steve Edelson. He looks the same—the years have not touched him. Steve informed me that he sold Edson Labs to Analog Devices and is now taking it easy. However, your secretary believes that before too long, Steve will be founding another company. I could see the signs of entrepreneurial addiction—I should know, having been similarly afflicted for most of the last 17 years.

As for myself, I'm still setting up an independent sales force to market data communication services

in the U.S. By the time these notes appear, we will hopefully not only have our sales force in place, but also be well on our way to distribution of our latest product—fax-to-text (ASCII) translation on the fly. This, believe it or not, is sexy in certain quarters! ... Please write, fax, or call. We urgently need your news.—Arthur J. Carp, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523, (516) 295-3632, Fax: (516) 295-3230

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Reunion time nears, my friends, June 4-7. I hope to see you all there!

Steve Bader reports that he got to contact several Pi Lambda Phi classmates during a '91 telethon, and that all are doing well. ... Christine Dowler was married in late 1990 to Roni Evron. They have their own computer consulting business writing application programs for brokerages, travel businesses, political fundraisers, and the textile industry. They had a little girl, Mallory, in October 1991, a redhead, and at four-and-a-half weeks already smart enough to know to spit up only when there is no diaper over your shoulder. ... Kevin Miller is entering his fourth year as medical director of the Center for Psychiatry at Holyoke (Mass.) Hospital, where he's also been chief of psychiatry for three years. His daughter, Rachel, was one-year-old in February. He's expecting to join us at the reunion to share more of his ups and downs. ... Another classmate who is reunion-bound is Jeffrey Casper, who lives in Mountain View, Calif. Since he is taking some courses in applied math and engineering management, with finals the week of June 8, he's expecting to get in some serious studying during reunion weekend! ... Ken McCreery reports that he is now living in Danville, Calif., which is near San Francisco. He is married and has four children. He has been in sales since leaving the Institute and is now the owner of a

15th Reunion

retail computer store.

Jim Hollowell is now residing in Scotland, between Edinburgh and St. Andrews. He writes, "I expect to be here until June 1993 working as the fabrication manager on a \$75 million North Sea platform substructure with Marathon Oil. Enjoying the outdoor activities available in Scotland, especially golf. Recently received a patent for a method of docking a substructure to pre-drilled oil wells." ... This past January while I was in Atlanta at the winter meeting of the American Astronomical Society with Paul Hertz, I ran into Alberto Sadun who is with Agnes Scott College. He sounded and looked very excited about his upcoming marriage, and gracefully excused himself from attending the reunion in order to participate in the wedding. Equivalent excuses will continue to be accepted. ... The last tidbit I will share with you before reunion time is that David Thompson, of Orbital Sciences Corp., has been honored with election to Fellow of the American Institute of Aeronautics and Astronautics in recognition of his commitment and contribution to aerospace. I am eager to learn of the low, medium, and highlights of your lives, and I will be (discreetly) carrying a notepad or other recording device during the reunion weekend to note them for posterity. You may even be crazy enough to re-elect your humble secretary, thereby making her spouse very unhappy. Please come and join in the fun and festivities. Till then—Ninamarie Maragioglio, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153-2252.

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News of MIT's most devoted Red Sox fan comes to us through an article that appeared in the Columbus, Ohio, newspaper. Aero/Astro Professor Paul Lagace noticed that after the roof behind home plate at Fenway Park was torn down and replaced with a higher one, home run balls that once soared

into the center field stands were falling short. In search of a research project for his undergrads, Paul had the students build a wooden model of the ballpark and test it in a wind tunnel. It turns out the higher roof created a vortex and could cause a fly ball hit to center to travel about ten feet less than before. Paul plans to have his students figure out a way to eliminate the effect.

Frances Scovil writes, "I just returned from two weeks in the Far East: Taiwan and Hong Kong on business, and Thailand and Singapore for fun. I was joined by **Cathy Greany** for the "fun" part. When not globetrotting, Frances lives in Boston's South End. . . . **Jeannette Wing** is back in the Boston area: "I'm back at MIT for one year, spending my sabbatical from Carnegie Mellon University as a visiting associate professor in the EE/CS Department. When I'm not being a computer scientist, I'm dancing (still!) ballet."

Congratulations go to **Yaneer Bar-Yam**, who was named associate professor of electrical, computer, and systems engineering at Boston University's College of Engineering. Yaneer specializes in material growth and superconductivity. . . . And **Dan Hillis** has received even more recognition for his work in parallel processing computers at Thinking Machines Corp. in Cambridge. The Foundation for a Creative America presented Dan with the 1991 "Spirit of American Creativity" award, recognizing creative contributions in the areas of invention and creative arts as a singular part of American life in the 20th century. In receiving this award, Dan joins the ranks of others who have been recognized through this award, among them Edwin Land, Leonard Bernstein, James Michener, Steven Spielberg, and Stevie Wonder! Dan's creation, the Connection Machine, is recognized as the world's fastest computer. This machine was the topic of his 1988 PhD thesis at the Tute.

Mark Pape says, "I have made the plunge into a start-up operation, EGG, Inc. in Arlington, Va. I am the director (and, indeed, the full division) of Environmental Engineering. My wife Diana (MSCE '82) is doing well and back at work at ICF, Inc. in Vienna, Va. Our two kids are fine, and they see us occasionally." Mark and family are living in Chevy Chase, Md. . . . **Gerry Epstein** has returned to Washington, DC, after a stint at Harvard: "I am now at the Office of Technology Assessment, where I am directing a study on the proliferation of weapons of mass destruction. The book I and four co-authors at the Harvard Kennedy School of Government have written on the relationship between military and civilian technology is now in press. Look for *Beyond Spinoff* early next spring, from Harvard Business School Press." Gerry now lives in Arlington, Va. . . . **Bernard Alperin** is now living in Rego Park, N.Y. "I have rejoined URS Consultants, Inc. in New York City as a senior transportation planner/project manager, following more than three years with the Port Authority of New York and New Jersey."

Sharon Pastoriza King writes us from the West Coast: "My husband, **Doug King**, passed the certification exam for manufacturing engineering (product design) and can now add 'CMfgE' to the 'PE' after his name. He has also been training the 50 employees in his company in total quality, which is very rewarding. I'm thoroughly enjoying watching 'my three sons' grow and learn and teaching the children at my church." Sharon and Doug and family are living in Berkeley, Calif. . . . **Sue Kayton** sent a card to tell us that she and former roommate, **Julie Kozaczka Stahlhut**, have been on the move. Julie went from Boston to Kalamazoo, Mich., for graduate school—in pursuit of her MS in computer science. Sue and family moved from Los Angeles to Menlo Park, Calif. Sue is now looking for a house to buy for her husband, two kids, a duck, and an iguana.

Julie Keller Pease wrote from Biddeford, Maine, to bring us up to date on her life. Son Evan was born in August 1989, and already has a good pitching arm! As the only woman psychiatrist in the area, Julie continues to maintain a thriving psychiatric practice. Julie says that she is probably

in the minority of physicians who will be very pleased when an equitable national health insurance system is developed. Julie quilts in her spare time, and has even dusted off her violin. Husband David works with the Portland Public Library. Julie says she has totally lost touch with friends in our class. (You can write your class secretary for her or other addresses!)

As you read this, your class secretary and wife **Diane Curtis** will be harvesting the first yields from the farm. We're starting small this year, with experience and education as our major goals. Kids Danielle and Luke are growing like weeds. We cherish our time with them very much.—**Jim Bidigare**, secretary, 9095 N. St. Rd., NW, Newark, OH 43055-9538 (614) 345-8582

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Ellen Essenfeld and husband Patrick Centanni, SM '81, had a baby daughter named Rebecca in March 1991. They make their home in Hingham, Mass. . . . **William Rust** and wife Marilyn also had a baby daughter last year. Bethany Anne was born 15 weeks early, weighing in at 1 lb.11 oz., and only 12 inches long! She came home in August and is doing fine. The Rusts live in Billerica, Mass. . . . **Michael Tarsi** wrote to announce—yes, a baby daughter! Lauren Michelle was born on March 19, 1991, and is an object of great intrigue to her 4-year-old brother Grant. The Tarsis live in Hampton, N.J.

Carol Cesari Tourgee is at AT&T Bell Labs in New Jersey, and is the mother of 27-month-old Adam. . . . **Gary Hebert** writes, "After working for dbx, Inc., designing audio electronics for eight years, I and two other members of the engineering department founded THAT Corp. and purchased dbx's OEM division. We have been in business for over two years now and are doing well supplying linear ICs and PC-level modules to the professional audio industry." . . . Frank Phillips, '36, sent me a picture that appeared in a New Jersey newspaper. The picture is of **Gary Isaacs**, although he is not apparently recognizable because he is wearing full clown regalia (including nose and makeup) and is juggling three balls! The caption reads, "'Don't let go of your dreams,'" says Gary Isaacs, 32, of New York City. He is shown here doing his juggling act at the Massachusetts Institute of Technology in Cambridge. Isaacs. . . started out as a scientist. Later he became a trader on Wall Street before finally pursuing his dream of attending clown college." Observant readers of this column may recall that I reported on Gary's apparent career change last year after someone sent me a *New Yorker* magazine profile of him. Say, Gary, why don't you stop relying on astute alumni/ae and fill us in yourself? . . . That's all for now.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

80

A short note from **Chien Huang** this month. He and his wife are both still working in the "Big Apple." They plan to start a family soon but for now enjoy traveling together on each other's business trips. . . . My first computer mail submission came from **Harvey Alcabes**: On January 23, Harvey's wife, Ellen Stromberg, gave birth to Sarah Beth. The delighted parents and new daughter live in Belmont, Calif., where Harvey has been working at Apple Computer for over 8 years. He is currently product marketing manager for object-oriented programming languages.

Class President **Kate Mulroney** and her husband Geoff Wall are the proud parents of Timothy Adams Wall, born January 9, 1992. They live in Washington Crossing, Pa. Kate also writes that **Joanne Tobias** has resigned as class agent and **Tim McManus**, who had been an officer-at-large, has replaced her.

Donna Bielinski sent her first letter to tell us what she's been up to for the last 12 years! She spent one year in graduate school at Boston College

and five years as a research assistant at Harvard Medical School. Her next stop was a PhD program in the Biochemistry Department at Boston University; in July 1991, she successfully defended her thesis. Donna is now back at Harvard Medical School as a postdoctoral research fellow. She closes with: "As you can see my educational process has been a long haul. But it's over, and it's such a relief! I just had to share the good news."

Share your good news by writing to: **Kim Zaugg**, secretary, 2384 Leslie Circle, Ann Arbor, MI 48105, (313) 665-2365, vayda@erim.org.

81

Intelligence sources have been busily reporting this month:

Get me to the church on time: **Rick Kotosky** has been very active on the wedding circuit over the last year or so, having attended six (!) during that time, including **John Noone's** in May 1991 (among other guests: **Max Klein**, recently **Dr. Klein**) and the wedding of Paul Malchodi, '78, in the summer (best man: **Mark Radka**). All of this has served as good preparation, because on April 25, 1992, Rick himself is to tie the knot with his fiancée, Ruth Ann Kokidko (Mass. Bay Community College, '81). The John Noone connection was at work here too: Rick met Ruth Ann about three years ago on a blind date secretly arranged by John. Rick also reports that he's been working for the last three years or so as a process engineer at United Engineers & Constructors, Inc. in Boston, looking forward to working on a new biotech facility that Genzyme is building in Allston. "And now for the frightening news," he continues, "I actually managed to pass the professional engineering exam, and in chemical engineering to boot." He now thinks he can at least get paid for working, but regrets having to give up his NCAA eligibility.

As to the aforementioned Mr. Noone, he and his wife Lisa have been married for about a year now. He tells us he's "adopted" Lisa's black Labrador, named Minga. Of late, John's been in the MBA program at Wharton and expects to be graduating this year, after which he intends to return to the Boston area and the high-tech marketing world. Also in the Philly area, according to John, are **Lou Bender** and **Eric Buckman**, who have recently entered Wharton, and **Pat Martin**, who's working for McNeill Consumer Products.

O Jerusalem! **Jeremy Barkan** informs us that he has been a freelance software consultant in New York in 1991 but expects to be returning to Israel, where he hopes to be doing object-oriented programming. Jeremy's also been in touch with **Avery Lampert**, '82, and his wife, Cheryl Walter, '84, and David Goldfarb, '84, and his wife, Heidi Brun, '84, all of whom are now living in Israel.

And wherever you are, have a good summer and let us know how you're doing.—**Mike Gerardi**, secretary, 1515 S. Flager Dr., #1204, West Palm Beach, FL 33401, (407) 655-5050 (w), (407) 835-9013

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10th Reunion

Please send news for this column to: **Stephanie Pollack**, secretary, 25 Royce Rd., Newton, MA 02159

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Javier de Luis writes that he is the head chef at his own Chinese food truck on the MIT campus. Javier specializes on Cantonese food, and is looking forward to taking the Royal East head on. Those of you still around MIT can support a classmate's entrepreneurial venture and snarf down a six pack of Peking ravigolis by stopping by Javier's.

Randy Schweickart and Michelle Heng, '84, sent in an extensive update from Pearland, Tex. Randy is a design engineer at McDonnell Douglas Space systems. He is developing water quality monitoring equipment for the Space Station *Freedom*. Michelle

has been juggling medical school, public health school, and her residency, and is taking the holiday season off to play with daughters, Ashley (6) and Marielle (2).

We received a press release from BU regarding **Laurel Carney**. After an electrical engineering degree at MIT, Laurel went to the University of Wisconsin for an MS and PhD in electrical engineering. She received the Rose Neuroscience Award from the University in 1990. Then Laurel did a postdoc at U/Penn. She has now returned to Boston, joining BU as an assistant professor in the College of Engineering.

Greg Dunn writes that he has been appointed science counselor at the American Embassy in Rome. He and wife, Barbara (Wesslund '84), and sons, Joe (4) and Charlie (3), will be moving to Washington for language training before reporting to Rome in August. Since MIT, Greg worked at Lincoln Lab and as special assistant to the Under Secretary of State for International Security, Reginald Bartholomew. He hopes to catch up with **Cliff Olsen** while in Washington. Cliff is still a Navy SEAL, and is on temporary duty in D.C.

Jeff Harris writes from Corvallis, Ore., where he is an assistant professor for the Air Force ROTC. Jeff has his students playing computer games with tactical nuclear weapons. He spends his free time as a Whale Watch volunteer. Jeff has so many ideas for class secretary contests, that I'd like to be the first to nominate him for the job for the '93 election.

Philip Kasten writes that he and Carolyn are proud parents of Marjorie Rose Kasten. . . .

Matthew Tobin is working for a paving contractor in Maryland. He was married in October 1991, but obviously isn't able to write his wife's name yet. . . .

Benson Louie was recently promoted to VP of MIS Development in Chemical Bank's Consumer Banking Group. . . . And finally, the long distance letter of the month from **David Mizan Hashim**. David is senior partner of Veritas, a multi-disciplinary design practice based in Kuala Lumpur. The firm has 30 staff members and offers architectural planning and design services. — **Jonathan Goldstein**, secretary, TA Associates, 45 Milk St., Boston, MA 02109

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Nancy Defeo and David Markuson became engaged last July. Nancy is now also a fellow MITRE employee. . . . **Michelle Keller** and husband, Ray, now have two children: Anna and new-born Theresa. They are still living near Kennebunk, Maine, and Michelle is working part-time as a project engineer at Fiber Materials doing R&D for advanced composites.

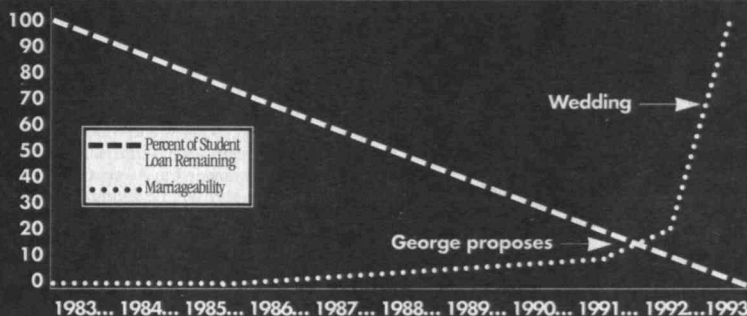
Received an alumni update form from **Howard Reubenstein** who writes that he is class secretary. . . . **Jay Fridkis** says he is still living in NYC and invites other alums to look him up. . . . An unnamed alumni, possibly **Peter Lemessurier** as deduced by his alumni class ID number, is currently working for Highland Energy Group in Boulder, Colo. They are implementing turn-key energy conservation projects for hospitals and public schools.

Stu Gitlow is one year into a psychiatry residency. He finally got his instrument pilot's license and is working toward a commercial license. Stu was just funded by the NIMH to develop a computerized multimedia workstation to teach patients about their medications. . . . **Barry Surman** has been covering Capitol Hill for the past three years and is now pursuing an MBA at Columbia Univ. He is commuting to Washington, D.C., on weekends to see his wife, Callie Pappas.

Karl Luce gave me a call. He has been working at Raytheon, just down the road, for the last five years as a structural engineer. He says he is almost out of student loan debt and is going to embark on hiking the entire Appalachian Trail. The walk will also be raising money for the Long Trail Protection Fund. Karl figures it will take between four and six months.

I received a copy of Carole and **Jeff Whaley's** "Big Adventure" newsletter. Seems the two of them

MARRIAGEABILITY VS. PERCENT OF STUDENT LOAN REMAINING FOR MARY WASILEWSKI, '83



Congratulations Mary & George from Lisa, Peter, Eileen, & Lars.

have been in Japan for four months, anticipating to stay about a year. Jeff had been working in the disk drive industry in the Boulder area. He married **Carole Youngren** in May 1990 and they had a mountain biking honeymoon in Moab, Vt. Jeff is currently working with Intellistor, a Fujitsu subsidiary. In the newsletter, they report: They visited Hong Kong, had an interesting experience with the taxi driver, and experienced the amazing shopping opportunities. In Japan they are taking calligraphy classes, apparently eating a lot of sushi, and experiencing the culture shock.

That is all for now. Next month: New Year's in Ludlow, Vt.—**Howard Reubenstein**, secretary doctor, 28 Mitchell Grant Way, Bedford, MA 01730, (617) 275-0213 (home), hbr@mitre.org.

85

Well, it finally happened. I missed a deadline because of travel over Christmas break. That's the bad news. The good news is that the roll over makes the column especially large this month. We will beat the Class of '86 yet.

First there is news provided by our beloved and fearless leader, **Inge Gede**, who complimented me on never missing a deadline—bad timing. Inge is still at Columbia. She saw **Dave Libby**, **Dave Fung**, and **Anita Killian** at the MIT Leadership Conference in September. She also writes: **Lauren Barrett** is in Brookline, Mass., with her own business translating technical Japanese. **Mimi Yenari** is at Stanford doing a neurology residency. **Lisa Shields** is taking some time away from her work in Australia to work in England. **Alan Foonberg** is still happily married and living in Manhattan Beach, Calif. **Adrian Wang** moved to Dallas in August—he ought to get a free flight to the 10th Reunion.

Chris Warrack is at an AFIT assignment, getting a master's, and will teach at the Air Force Academy. **Kathy "Liar's Poker" Carmody** is still working for Saloman Brothers in NYC. **Phyllis (Hae-Young) Chun** is also living in the Big Apple. **Prisca Chen Marvin** is expecting her second child in August 1992. **Kim (Fradd) Saxton's** daughter, Lyndsay, is fine at age one-and-a-half. **Suresh Srinivasan** lives happily in New Jersey. **Peter Yu** should be receiving an MIT PhD this June.

Ram Malikalingum is in the political science PhD program at our alma mater. **Linda Matthew** is doing fine in Peekskill, N.Y., while **Mary Petrofsky** is still hard at work, sports, and play in the Bay Area. **Stephanie and Jeff Winner** are expecting their second child some time in late spring/early summer. All this news makes it is pretty clear why Inge is our president.

Now for the rest of the news. **Kathy Geary Balles** and her husband **Eric Balles**, '80, announce the birth of their second child, Joseph Edwin, on September 30, 1991. Also she says that **Kris Dinsmore** married **Dave Whitney** in June 1991 with attending MIT alumni **Lou Martinage**, **Pauline Liu McCormack**, **Libbo Patterson**, **Jen Snopkowski**, '86; **Caroline Lenoard**, '84; **Eric Vance**, '86; and others.

Vince Young is still working on his MD/PhD at Stanford and is looking for residencies back in Boston. He attended the wedding **George Jacquette** and **Juliet Sears** in September 1991 and saw **Brad Files**, '84; **Bob Schoenlien**, '84; **Brett Miwa**, '87; and many other ATO's. . . . **John Ragan** is an American Cancer Society Postdoctoral Fellow in the UC Berkeley Department of Chemistry. John finds the weather here entirely too mild and looks forward to returning to the Northeast.

Joan T. Muellerleile married **Dumont M. Jones** of St. Louis in March 1992 in Hyde Park, N.Y. Joan was awarded a PhD in materials engineering science at Virginia Tech in September 1991 and is working as a postdoctoral research associate at Monsanto in St. Louis. **Kip Dee Kuntz** is currently working at Space Telescope Science Institute as a science data analyst. He says that he is really doing his thesis work, and if all goes according to plan, he will be going to Rijksuniversiteit Groningen for a PhD starting in the fall. Otherwise, he and his lover bought and are now restoring an 1880s, three floor, marble-fronted townhouse in urban Baltimore. . . . **Anne Lumsdaine** recently returned to work after a disability leave dating from 1987. Anne won an NSF Creativity Fellowship in 1990 and started grad school at UC Berkeley in spring 1991. In summer 1991 she married **James Ross**, a NASA engineer, sailboat design consultant, and amateur guitar maker. The wedding was held at 700-year-old St. Jost Kapelle, Ennetburgen, Switzerland, and was attended by alums **Ann (Ito) Attenasio**, '87, and **Hyojong Kim**, '84. Northern Calif. alums are invited to drop them a line at 600 Mountain Blvd., Oakland, CA 94611.

Scott Penberthy just returned from a two-year resident study at the University of Washington where he completed his candidacy requirements for a PhD in computer science. He is now working on his thesis back at IBM Research in New York and should graduate this year. Living in Greenwich Village is a constant source of much needed distraction from PhD research, he says. Also he and **David Donnell** attended the first annual Scrum Dance festival along with **Kerry Hooks**, '84; **Mike Maguire**, '86; and **El Ron**, '69.

Talk about living the good life: **Barry McQuain** left Chicago in May 1991 with his wife, Karla, and went backpacking with four others along the Pacific Crest Trail from Lake Tahoe to Crater Lake, carrying 50-pound packs for 500 miles. Since then he has rejoined the (in)securities industry where he is director of risk management for Woody Creek Capital, a money management firm. . . . **Pete Smoot** sent in his first news since graduation. He writes, "After '85 I hung around MIT for another two years getting an MS in VI-3. After graduating I started working for Hewlett-Packard in Cupertino, which is where I still am. In August '89, I married **Laurie Sexton**, a genuine California native (yes, there are some in the Silicon Valley). Finally, in November we did our part to stimulate the economy by buying our first house."

Dave Lineman just formed a new band devoted to science and the environment called **Avogadro and the Numbers**. Look for them on the top 40

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charts in a couple of decades or so, he says. . . . **Roy Peterkofsky** says that a job with USAir has its benefits. In the last two years he has been to Canada, Mexico, Nicaragua, Holland, Germany, Switzerland, Zaire, and Indonesia. He almost married a (real) princess in Indonesia, but had a last minute change of heart. . . . **Josh Makower**, MD, is now working with Pfizer developing new medical devices. At night he plays with the rock group, Still Trust, and he continues to write music in his spare time. He will be married in August 1992.

Julie Forman-Kay will be taking a position as a scientist in the Department of Biochemistry Research at the hospital for sick children in Toronto. . . . **Roberto Engels** is just trying to survive Brazil's inflation. . . . **Richard Corkran** has a new job as a pilot for American Airlines. He now lives on a 500-acre farm in Delaware where I guess he can just land the airplane after work. . . . **Adam Brody** received an MA in psychology at San Jose State University. He bumped into **Mike Scardera** and **Mitch Clapp**, '84, at the International Astronautical Federation Congress in Montreal. . . . **Marie Cunningham** was just promoted to technical production manager at NOVACAP, Inc. Marie is a part-time DJ for two night clubs and serves as an Educational Counselor for MIT and as a member of the board of the Southern California Ceramic Society.

Erik Devereaux completing his PhD in political science after joining the faculty of the Carnegie Mellon University School of Urban and Public Affairs. He married Olivia Mize (UT-Austin, '91) in Houston. They are rapidly acclimating to Pittsburgh, which he says is a truly wonderful city. . . . **Lt. John Marti** received a law degree in 1991 from the University of Oregon and is now defense counsel for the the Marine Corps in Hawaii. John and his wife, Elke, have a six-month-old son, Colton. . . . **Gerald Baron** has a new job as European sales manager for Computone Corp. and bought a house in Alpheretta, Ga., outside of Atlanta. He and his wife, Lorraine, had a baby girl, Jacqueline Monique, in May 1991.

With the birth of his first son, Kyle, **Michael Druding** changed positions at Corning to a central engineering function with projects at various specialty Materials Division plants. . . . **Marcy Wong** and **Renato Zenobi** were married on October 12, 1991. MIT grads attending included **Nancy Voke**, **Chieko Aoki**, **Ann Willerford Harris**, and **Rob Harris**, '84. Marcy and Renato moved to Switzerland in January 1992. . . . **Susan Lovich** married **Ralph Siegel**, '83, and is finishing a residency in pediatrics at Presbyterian Hospital in New York in June. . . . **Miha Park Fader** is climbing the corporate ladder at the Chemical Products Group of FMC Corp where she is now assistant controller. Just another rung or so to CEO!

This month's e-mail addresses: **David Libby** libby@mitvmc.mit.edu, and **Pete Smoot** <petes@hpindba.cup.hp.com>. Send in more addresses!

Now announcing the Class Secretary Sweepstakes. I would like a greater variety of people to send in news. So using the latest computer technology, I am going to randomly pick three classmates per column and mail them a request for news. The winners this time are **Lt. Gary Brown**, **Daniel Frost**, and **Arlene Yen**. With any luck and some cooperation, news from them will appear next month. While you may have already won, don't leave your news to chance. Send it to—**Bill** "But-I-don't-WANT-to-graduate" **Messner**, secretary, 2234 Jefferson Ave., Berkeley, CA 94703, messner@cmls6.berkeley.edu.

86

On February 8th I attended the social event of the season. What you ask? Why, the **Karen Wohl-Ray Schmitt** wedding, of course. These kids tied the knot in Rye, N.Y. (same place as George and Babs Bush). It was a wonderful ceremony and a great reception. Lots of MITers were in attendance: bridesmaids included myself and **Ellen Epstein**,

ushers included **Dave Alschuler**, **Joe Parris**, '85, and **John Jennings**, '84 (it was a TDC mini-reunion). **Anne Fricker** and **Jim Hutchinson**, '85, came down from Boston for the festivities. The highlight of the weekend was the swearing in of Ray as an Erik/Eric as we welcomed him into the ranks of the Ellens. To catch up: Dave and Jill live in Brookline, Mass.; Dave is still working on a PhD in genetics from Harvard. Joe lives in Reston, Va., and works for NASA. He's involved with coordinating the Space Station effort with the particular contractors and international partners. John and Marty are living in Alexandria, Va., and I thought I heard John was also working for NASA (correct me, John, if I'm wrong). Ellen is still working for Morgan Stanley and happens to be dating another Eric (who has the most enormous cat I've ever seen). Anne is living in Boston, as is Jim. She seems to be enjoying the large amount of free time she has. Maybe she's contemplating another trip to England.

Well, Karen and Ray wouldn't give us any flight information for their honeymoon. I guess they were worried Erik and I would show up in Tahiti and find them. Little worry, though. We have other plans like skiing in the Air Force Ski Meet in Utah the first week of March. That'll show 'em, yeah. Anyway, congratulations!

I did receive a few letters this month. Thanks to all of you who take the time to write. **Noel Zamot** called in from Grand Forks, N.D. He will be married on May 30, to Diane who I gather is also in the Air Force (Noel described the joy of trying to work joint assignments). He is now flying in a B-1B as is **Rich Maurer**. **Jim Wilkerson** is also in North Dakota. He's still flying tankers. Noel passed on some news about other '86ers. He thinks **Andy Solem** got married last October. **Marilyn Oberhardt** is still in Boston, and **Carl Resnik** is still at GE (though he did finish an MS from MIT).

Desmond Kirkpatrick is in graduate school at Berkeley working for a PhD in electrical engineering. . . . **Julie Chen** was named an assistant professor of aerospace and mechanical engineering at Boston University's College of Engineering. . . . **Darryl Robinson** was named by *Urban Profile* magazine as one of the nation's leading young black achievers. Darryl is president of Robotica Automation Consultants of Boston, a computer consulting firm that helps clients of all sizes to profit from computers. . . . **John Schuette** is working in the Artificial Intelligence Group at Exxon Production Research Center in Houston. . . . **David Cultice** graduated from Clemson Univ. in August 1991 with an MS in mechanical engineering. He now works for Parametric Technology Corp. as a test engineer in mechanical design automation. He lives with **Keith White** and **Dave Sperry**.

Tom Kurfess and his wife **Adriana**, '87, are House Masters at Carnegie Mellon. They'll be at Lawrence Livermore Lab in California this summer. While they were visiting on the West Coast, they saw **Sanjau Govindjic**, Eugene Tung, '87, who married **Lisa Vingerhoet**, '88; **Tom Abel**, '87; and **Peggy Moore**. . . . **Scott Bentivegna** married on September 11, 1991. He honeymooned on a cruise in the Caribbean and then moved to Florida. He now works for Florida Power and Light Utility Co. as a procurement engineer. . . . **Anthony Jordan** is a senior programmer/analyst implementing relational database applications for SilverPlatter Information Inc. in Norwood, Mass. He shares an apartment with **Erik Bettez**, '87, in Southborough.

Stan Shull received an MBA from Harvard Business School last spring and moved to Seattle, Wash., to take a position with the Boeing Co. as a strategic analyst for corporate engineering and technology. . . . **Robert Lenoil** went tramping through New Zealand last December and stayed at **Fred Huettig's** place on Maui on the way back. Fred was working for Lincoln Labs at the observatory atop Mt. Haleakala but is now back in Boston. In February 1991, Robert left Apple, in May he finished an MBA, and is now an independent software consultant while looking for a senior management position with a small company. With all the frequent flyer miles he's accumulated, he hopes to fly to Africa and go on safari sometime this

year. This July he'll be in New Orleans for the annual barbershop singing convention. Robert attended **John Rulnick's** wedding in August 1991 where he met all of his Phi Kappa Theta brothers.

Well, that's all for now.—**Mary C. Engebret**, secretary, 1805 Manhattan Ave., Hermosa Beach, CA 90254, (310) 376-8094

87 5th Reunion

I hope you're all enjoying the summer sun, because I have some more good news for you. Once again your classmates came through and wrote to me. Here's the latest scoop. . . . **Emilio Lopez** transferred to Austin, Tex., in January to continue his work for Chemcut Corp. He writes that he is an applications engineer in a field-service capacity for the electroplating chemistries used to manufacture printed circuit boards. . . . Congratulations! **I-Chun Lin** married Othar Hansson (Columbia, '86) on January 1 in Sydney, Australia. I-Chun was born in Taiwan, and Othar in England, so the two wanted to get married in a more exotic place. I-Chun is currently working as a project manager at a software company in Berkeley, and Othar is finishing a PhD in computer science at U.C. Berkeley.

Sangwook Tim Yoon is in his fifth year of an MD/PhD program at Yale Medical School and is hoping to finish in seven. Good luck! . . . **Molly Kihara** received a master's in engineering management from Stanford University. She is currently a group leader for the regulatory compliance group at Radian Corporation's Environmental Services Department in El Segundo, Calif. . . . **Roger Applewhite** will be completing an MBA at UCLA in June. He is also part owner of an engineering consulting firm, Altadena Instruments, in Pasadena, Calif. The company is now finishing a project with CalTech and JPL on a Mars Observer Camera to be launched in September.

Walid Nasrallah writes: "After being haunted for a couple of weeks by the 5th Reunion, I flew to Kuwait and worked on repairing yet another palace for the Emir of Kuwait. That lasted three months. Now I am back in Cambridge applying to PhD programs. I will be in Kuwait earning my (future) tuition until next September. Hope to see some of you then!" . . . **Carl Weiner** writes: "After receiving an SM from Stanford, I decided to look to the nonprofit sector for meaningful work. I am currently a volunteer in residence at Magic, Inc., in Palo Alto, where I manage a project to restore the ecological health of degraded oak woodland owned by Stanford University. I am living in a community with seven other people, including my San Diego-raised girlfriend, Pam Engbreghof. Pam and I have been enjoying bicycling all over the Bay area."

Michael Thomas also wrote in: "I have dropped out of the doctoral program in economics at the University of Pennsylvania, which I started in July 1990, to take a job with the Foreign Service. I was one of about 120 people nominated for the position by President Bush in October. Our nominations were confirmed by the Senate on November 20, and on November 21 I was commissioned as a vice-consul in the Consular Service and third secretary in the Diplomatic Service. I leave in mid-January for a two-year rotational tour as consular officer and political officer at the U.S. Embassy in Georgetown, Guyana." (Michael, please give us an update!)

I also got a great letter from **Mimi Bloom**, **Amy Austin**, and **Susan Zarzeczny**. Read it for yourself: "The three of us are celebrating New Year's together in Boston and decided we'd write our first letter for *Technology Review*. We are all back in school after living in California for a while. Amy Austin and Mimi Bloom were roommates in Palo Alto, while Amy was working for Watkins-Johnson and Mimi was working for Applied Decision Analysis. Susan Zarzeczny was working for Kaiser Permanente in Oakland. Susan stayed in the Bay area to get a master's degree in biostatistics at U.C. Berkeley and will graduate this June.

"Amy is back at MIT in the Leaders for

Manufacturing program. She will work for Johnson and Johnson in New Jersey for her internship project and will graduate in June 1993. Mimi is at Harvard Business School and will get an MBA this June. Although first-year business school was a grind, Mimi had a fun summer in Seattle working for Microsoft.

"Mimi and Amy were at a New Year's Eve party in Cambridge, attended by several MIT people. From the class of '85 we saw Gary Sabot, Andy Renshaw, Jim Hutchinson, Marty Rauchwerk, Nancy Defeo, and Bill Messner. Also there were Steve Lanzendorf, '84, and Ann Fricker, '86.

"Susan attended a Christmas party at the San Jose, Calif., home of **Maria Galiano** and her new husband, Mark Hoinkis. There she saw **Bob Brodersen** and his fiancée **Karen**; **Patty Manning** and husband **Mike Zinn**, '86; **Kay Yamaguchi**, '88, who is engaged to **Pierre Chevray**; and **Derek Aqvi**, who recently bought a condo in San Jose. Susan also has seen **Betsy O'Neill**, who is getting a PhD in biology at U.C. Berkeley. When Betsy is not attending to her flies in the laboratory, she is playing the cello in the university orchestra."

Not bad, huh? You guys are finally coming around. Keep it up by writing to me. See you at the Reunion!—**Stephanie Levin**, secretary, 159 W. 80th St., Apartment #1D, New York, NY 10024, (212) 595-3172

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Joyce Wong writes that last December, **Chris Lindsay** married **Pat Farley** in New Hope, Pa. Quite a few classmates were at the wedding, including **Martha Lyman**, **Pat Maler**, **Diane Duckworth**, **Karen Ciacciulli**, **Jill Wohl**, **Paul Pettigrew**, **Jan Goldman**, **Tara Brown**, **T.C. Lau**, **Vivian Ma**, and **Joyce Wong**. **Chris** works at **CNR** in Needham and **Pat** is a mechanical engineer at **Ford Motor Co.** **Jan** is in medical school at **UC/San Francisco**. **Joyce** is working toward a doctorate at **MIT**. **T.C.** is a computer consultant for **SQL Solutions (SYBASE)** and **Martha** works at **Oracle**, the competition. **Diane** is a consultant at **Booz-Allen and Hamilton**. **Karen** teaches at a prep school in **Asheville, N.C.** **Vivian** works at **IBM** in **Wappingers Falls, N.Y.** **Jill** is working at an advertising firm which represents "Snap, Crackle, Pop; the Pillsbury Doughboy, and the Jolly Green Giant" in **Chicago**. **Paul** is an architect at **Perkins and Will** in **Chicago** and **Tara** is in the graduate school of architecture at **Yale**.

Sean Beausoleil is pursuing an MBA at **Emory Business School**. He was able to get together with **Greg Martin** a few months ago while he was in **Atlanta** for the **Society of Mechanical Engineers'** conference. . . . **James Harrison** has done some moving from **D.C.** to **Stamford, Conn.**, and back to **D.C.** He opened the **META Group's** first remote office in **Reston, Va.** **James** says he is looking forward to getting back involved with the young alumni group he started two years ago. . . .

Anthony Owens is in the electrical engineering PhD program at the University of Maryland, College Park.

Anton Briefer writes from **Minneapolis** where he is attending graduate school at the University of Minnesota studying environmental chemistry. He finds **Minneapolis** a great place for outdoor activities although the weather leaves something to be desired. **Anton** plays frisbee with the University's ultimate club every Sunday, even in the snow! . . . Navy Lt. **David M. Silldorff** writes that he was at sea in the **Persian Gulf** with **Tactical Electronic Warfare Squadron-140**. **Naval Air Station, Whidbey Island, Wash.**, and is mid-way through a six-month cruise.

As for things here in **New York** in **February**, I just finished all my interviews for residency programs in general surgery. I had a great time on the interview trail traveling from coast to coast meeting new people and running into MIT alums. I was amazed to discover how many MITers are also going into surgery. Among those I ran into are **George Huang**, **Joe Woo**, **Audra Noel**, **Alexa Page**, **Grace Kim**, and **Suzi Kelly** (from Mt. Sinai

Medical School). I know there are more going into surgery—refresh my memory. I also hear that **Julie Safirstein** and **Christine McIntyre** are going into pediatrics. I'd love to hear from you, where you're going and what you're going into.—**Grace Ma**, secretary, 545 1st Ave., #7R, New York, NY 10016, (212) 447-1925

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Well, over the last year, I've gotten about 10 letters delivered by the U.S. Mail (that is, for class notes), about 50 e-mail letters, and about 40 little slips of paper the Alumni Offices receives with their fund contributions. So please, whether by Post, e-mail, or the Fund, please continue to send information. Those summer vacations are coming up, so let us all know how you are!

Thomas Farkas finished an MS in EE at MIT this past September, then traveled to Israel for two weeks. **Tom** is now living in the **New York City** area (Ossining) and is working on lighting electronics at **Philips Labs**. **Tom** recently held a party and the guests included **Brian Luschwitz**, **Dean Ebesu**, and **Tim Sulzbach**. . . . **Sabina Skulsky** is working at the **Ford Motor Co.** as an analyst in product planning/powertrain activity. She is living in **Southfield, Mich.** . . . **Rebecca Smith** is "still in **Idaho** for now." She has been "skiing and partying with the local Alpine Club; **Idaho Falls'** answer to the **MIT Outing Club**." **Rebecca** also reports that "WINCO is treating me well."

Terry Donahue is at **NEXT Computer** working on graphics software. . . . **Karen Yu** is in her third year of a PhD program in the neuroscience division of the psychology department of **Vanderbilt University**. **Karen** has been doing research on human visual perception. **Karen** received an MA in December. . . . **Michael Rechten Jr.** is finishing up his last year at the **University of Notre Dame Law School**. After graduation, **Michael** will be working as an associate with the **Grand Rapids, Mich.**, office of **Dickson, Wright, Moon, Van Dusen & Freeman**. During January, **Michael** went skiing with **Kee Wee** and **Eugene Lou**, '90, in **Breckenridge, Colo.**

Daniel Chang finished an SM in aero/astro at MIT last June, and since then has been working at **JPL** on articulation control for **CRAF/Cassini** probe missions. **Daniel** says that "you can't walk ten feet without bumping into another MIT grad around here." . . . **Michael McGovern** started out as a summer hire at **CSX Transportation Co.** in **Jacksonville, Fla.**, last June, but was offered a full-time position as economic analyst for the **Cost and Economic Analysis Group** in the finance department there. He has really been enjoying the job and the warm weather. . . . **David Flanagan** has been working as a consulting programmer and a technical writer. **David** recently authored the *Programmer's Supplement for Release 5 of the X Window System, Version 11*, which was published by **O'Reilly and Associates**. The book's cover describes it as one of "the definitive guides to the X Window System."

Marc Itzkowitz is still at **GM** and should not be affected by the latest round of cuts. **Mark** has been responsible for developing the market research for the **GM Electric Vehicle** ("well, more like coordinating the development") and recently developed an interactive information center that is on display at the **New York GM Building's** showroom. **Mark** had the joy (and the panic) of presenting it to **GM's** chairman. **Mark** recently got engaged to **Julia Kossack** and they then took a trip together to **Egypt**, spending three weeks in **Cairo** and five days cruising on the Nile. He writes: "Egypt is a very interesting and colorful place. **Cairo** makes **New York City** look tame."

Heather Huber is currently working on an MBA at **Wharton** (first year) and an MSE in systems engineering (**University of Pennsylvania**). **Heather** ran into **Allen Grove** who is working on a PhD in **English**. Around campus, **Heather** has seen **Eric Deering**, **Bill Webb**, '81 (both also at **Wharton**); **Theresa Chow**, '87; **Martin Taylor**, '83; and **Jane Byers**, '90, who is in the EE program. . . . **Mona**

Caesar is a 1st Lt. in the Army and they are keeping her busy.

The rest of the column comes by way of **Alan "Ziggy" Perzigian**, since I've included most of his letter here. Here goes: "I guess it's been about a year since I last checked in with you, and believe me it has been a busy one. As of my last letter, I was starting my own consulting company to the bar/restaurant industry. Liquid Assets Inc. lasted about ten months. That's about ten months longer than I expected it to. It's amazing how many people are willing to pay you money to tell them that they are not spending their money properly. The biggest problems I encountered was the fact that my fees were costing my clients more than I could save them with my advice. Oh well, no one said it would be easy." Andy continues, "National Toner... is a company that my cousin and I started three months ago. We recycle toner cartridges for laser printers and copiers. So far the response has been tremendous. We offer our customers a much needed alternative to having to continuously buy overpriced toner cartridges for their machines when they know in their mind that they should be rechargeable. We are also helping out the environment by keeping used cartridges out of our country's landfills. How's that for being a politically correct company?" From the Stamford, Conn., base, they are currently advertising throughout the Northeast, and hope to cover the entire country by next year. National Toner can be reached at: 1-800-676-0749.

Alan also sent in some information about other classmates. **Alan Diccio** finished his first semester at Stanford relatively unscathed. **Howard Eisen** is still working at JPL where he is in charge of coordinating an upcoming flight project. **Mark Housman** is still enjoying life as a newlywed in Cincinnati, where he is attending medical school. **Phil Lentini** has started working at General Dynamics Electric Boat Division and is no longer living in Philadelphia. **David Robertson** is still working in Connecticut. **Kevin Maguire** is also at JPL and has started taking up ballet. Alan has "been frequenting many of Manhattan's fine drinking establishments with some of my fellow fraternity brothers and some ex-Crossroads employees."

Thanks to all who wrote this month!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142, (617) 225-6680, e-mail: tripleh@athena.mit.edu or henry_houh@mit.edu

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Our apologies go to **Vivek Rastogi** for printing misinformation about him in the November/December 1991 issue. He shared a house with **Arturo Zacarias** in Palo Alto, Calif., and not in Menlo Park, as erroneously mentioned earlier. He currently lives with **Scott Duncan** amidst the trees in Portola Valley, Calif., and continues to work for Hewlett-Packard in Palo Alto.

Humphrey Chen started a new job in October. He's now working at Price Waterhouse in the New York City area. Humphrey is a staff consultant in the Management Consulting Services Division. ... **Will Botti** is also working in New York City. Will is working for Financial Sciences, designing and coding corporate treasury software. He's busy automating the treasuries of two clients, GE Capital and ITT Financial. Financial Sciences is a start-up company with only ten employees so far. It's located on the southwestern tip of Manhattan. Will encourages any programmers with an entrepreneurial spirit to send their resume to him at: Financial Sciences, 17 State St., 6th Floor, New York, NY 10004.

Brian Hunter is working for Banwell White Arnold Hemberger & Partners, Inc., architects in Hanover, N.H. He's also keeping busy working on his own house! ... Second Lieutenant **Marc Block** has just finished a master's in industrial engineering (quality and product reliability) at Rutgers University. He'll be stationed at Norton AFTS (San Bernardino, Calif.) starting in June. Bruce Lundre,

'88, is already out there at Norton. Marc has also participated in a professional soccer match! He was a linesman for the match between Penn-Jersey Spirit and Helsinki, Finland.

Out west in the San Francisco Bay area, **Deborah Bouchard** is working in the Employee Training Department at Oracle Corp. Before Deborah went to Oracle, she had earned a master of arts in teaching (science education) from Boston University. ... Congratulations to **John Reardon**. John and his fiancée, Amy, are planning on a June wedding. They've asked John's close friend, **Dean James Tewhey**, to be the best man, but they're still waiting for an answer from him. Best wishes to John and Amy! ... Best wishes also to **Eric Monsen** and his wife, **Stephanie Lynch**! They were married on April 5, 1991.

Our class president, **Joe Babiec**, writes in from London, England, with some class news. ... Remember the clock? **Brian Hunter** has been leading the effort to produce a design concept. He's been busy working with Robert Simha from the MIT Planning Office and William Andrews from the Harvard Scientific Instruments Museum. They've already produced a drawing and a small model of how the clock would appear on the face of the Student Center. Currently they are waiting for feedback on the designs from different people. Also they are working on figuring out who at the Institute will need to give final approval when the time comes (i.e., the Corporation). If anyone is interested in more details of the clock project or would like to offer suggestions, please feel free to write to Joe Babiec at babiec@vax.lse.ac.uk or myself, and we'll make sure the information gets transferred to the correct people.

Did everyone who ordered a class directory receive one? Working with Gloria Hodgins at the Alumni/ae Association, **Mini Gupta** managed to put out a super volume with the names and addresses of nearly everyone in our graduating class. The book sold for only \$3 and turned out to be a great success! There may still be a couple of copies left, so if anyone is still interested in purchasing one, contact Gloria Hodgins, Bldg. 10-140 at MIT.

That's it for this issue. Enjoy the summer, and don't forget to write in! Please send news to **Ning Peng**, secretary, 355 South End Ave., 27G, New York, NY 10280, or call (212) 745-2704 (work)

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"Hi!" writes **Albert Lew**, "I'm currently working at Teradyne in Agoura Hills, Calif., as a software engineer. I'm living with Anita Colasante and our fluffy cat, Henry. In the mornings, I ride with the Conejero Valley Cyclists. We've even had the '84 Olympic silver medalist, Steve Bauer, show up on the ride!"

Last July 27, **Anthia Chen** and Bryan Olmstead were married in a little church near her parents' home in Charleston, Ill. **Danielle Ford** was the maid-of-honor, and **Maria Yang** and Jill Netka (G) were Anthia's bridesmaids. Other MITers at the wedding included Julia Stowell, '93; Monica Dodds, '93; and Rick Buellesbach, '90. Anthia lives in Cincinnati where her husband attends school and Anthia works for Procter & Gamble. She is working as a process engineer in the Dishcare Product Supply Organization. "So far it's been very interesting," she writes. "I've been doing a Course X job with my Course II background." She sends news about several classmates: **Melissa Norcross** is also working for Procter & Gamble in Cincinnati, and **Benigno Salazar** works in P & G's Sacramento plant. **Maria Yang**, **Beth Pruitt**, **Joseph Gomes**, **Michelle Kao**, and **Lauralee Grizaffi** are all in graduate school at Stanford. **Shanna Kovalchick** has finished her second undergraduate degree at MIT. **Debbie Moynihan** is working for Ford's Car Product Development Division.

Greg Black married Tara Wylie on January 4. Greg studies at Cornell University and he and Tara live in Ithaca, N.Y. **Tamara Schulman** is in Paris, France, "freelancing in architecture, eating baguettes, and dancing all night long." **Derek**

Mayweather is studying at Stanford and was preparing to take his qualifying exam for a PhD when he wrote. **Mike Beachy** and **Robin Kullberg** are roommates in Columbus, Ohio. Mike works as a developmental chemist at Ashland Chemical, "has a beard, and wears a tie to work." Robin works part-time in a library and takes art history classes at Ohio State. In their spare time, they have seen the band Unrest and MTV retrospectives.

I spoke with **Paul Duncan**, who now lives on the waterfront near Houston and works for Oceanering Space Systems. Paul is working on a project for NASA which will make training for spacewalking more realistic for astronauts. The project will allow astronauts to train in swimming pools without being attached to an umbilical cord. Traditionally, astronauts had to employ the umbilical cord while underwater, which constrained their freedom of movement during training. Paul works with other MIT graduates and has met some of the astronauts for a game of pool. Before moving to Houston, Paul worked as a first mate on a sailboat which toured Baltimore Harbor. In the evening, after mooring the boat, he only had to cross the road to arrive at a second job in an Irish pub.

Renee Mong is engaged to Scott Miller, '89. Scott proposed to Renee at the Top of the Hub and they plan on marrying in the summer of 1993. Renee will have finished an SM by then and will be preparing to begin her military commitment. Scott and Renee both work in the SPPL lab and met her freshman year in Burton. "We didn't get to know each other well, though, until a year ago when my senioritis prompted me to write e-mail to him every day." Renee writes that she is sharing an office at MIT (37-458) with four other members of our class: **John Conger**, **Mohanjit Jolly**, **Esteban Torres**, and **David Cho**. "David was the 16.53 TA last term," she writes. "Now he is the 16.54 TA, though he's never taken the course. John, Esteban, and I can often be found staring at computer terminals working on numerical simulations for Professor Hastings. I'm working on simulating solar cell arcing, and determining what factors can reduce that arcing." Renee sends news about two more MIT classmates: **Lynore Abbott** is in graduate school at U Mass and has moved to a new house to exchange baby-sitting and cooking for room and board. **Chantell Wyland** is training for an acquisitions job at Lowry Air Force Base, Colo., before going to her permanent Air Force assignment in Los Angeles.

Andrew Lewin was awarded one of the Marshall Scholarships for study at a British University. According to a recent article in *The Tech*, Andrew will receive bachelor's and master's degrees in Course XVI this June before studying management for two years at the University of Sussex. Only 40 scholarships are awarded each year, and Andrew was one of two MIT students to receive one.

Amy (Anderson) Chang writes that she is in the lab almost full-time now that she has begun to explore her thesis project at Harvard. Her husband, Andy Chang, '87, is working in Lowell at AOL, a machine vision company. Amy recently spoke with **Aaron Sodickson** at the MIT skating rink. Aaron is in the HST program working on a PhD in physics and is considering an MD. Amy also keeps in touch with **Danielle Ford** who was a TA for a course at Brown during the fall semester and has begun working on her thesis in a geology lab.

Well, it looks as if MIT is planning to graduate another class pretty soon, which means there will be activities for alumni/ae to attend on campus. On Technology Day, June 5, faculty and deans will discuss "How Can American Organizations Excel in the 21st Century?" The next day, we are invited to a barbeque and the alumni games. If you would like tickets to "Tech Night at the POPS" please call the Alumni/ae Association at (617) 253-8230. These events should be fun, so I hope to see many of you there.

If you haven't had the opportunity to write yet, please send me a note and I will include it in the next Class Notes. —**Andrew Strehle**, secretary, 12 Commonwealth Court #10, Brighton, MA 02135, (617) 232-2261

I CIVIL ENGINEERING

Bill Roberds, SM '75, ScD '79, sends word from Kirkland, Wash.: "I was married last year and promptly had a beautiful daughter (Anna). In between, I have continued to work with Golder Associates, an international geotechnical consulting firm. I have been with them for 11 years and was recently promoted to principal (aka senior partner). I continue to work primarily in the area of probabilistic risk analysis, applied to resource and waste management projects." ... Last December, **Andrew F. McKown**, SM '78, was promoted to associate at Haley & Aldrich, Inc. ... **Asaf A. Qazilbash**, SM '65, CE '67, writes: "I am the father of 4 children. My son, Muzafar, has graduated from Bowdoin College and is in graduate school at the University of Rochester. My daughter, Jehanasa, has graduated from Connecticut College and is gainfully employed. My other daughter, Jasmine, attends Emory University in Atlanta. My fourth child, Jamil, is a senior in high school." ... **Rodney Plourde**, SM '68, PhD '71, joined McMahon Associates, Inc., transportation engineers, in March 1991 as VP and manager of the firm's Willow Grove, Pa., office. ... **Dan King**, SM '90, reports: "I am currently the Public Works Officer at the Naval Air Station at Barbers Point, Hawaii." ... **George Raymond, Jr.**, SM '82, writes: "As systems analyst with Danzas, a freight-forwarding company based in Basel, Switzerland, I am helping manage Dänznet, the firm's worldwide communications network." ... **John C. McDugald**, SM '79, retired from the U.S. Army in 1990 and is now teaching middle school science. **Wayne C. Huber**, SM '65, PhD '69, reports: "I have moved from the University of Florida to Oregon State University in Corvallis, where I am the new head of the Department of Civil Engineering." ... **James R. Pagenkopf**, SM '75, was promoted to VP at Tetra Tech, Inc., in Fairfax, Va. ... From Newfoundland, Canada, **Benedict F.**

Alexander, SM '65, writes: "I am president and owner of Fabax Limited, a consulting engineering firm in Western Newfoundland. I operate a big game (moose, caribou, and bear) outfitting business in September and October each year. I am president of and help with fund-raising for the Sir Thomas Roddick Hospital Foundation. I am enjoying life—fishing, golfing, and hunting—but still working hard." ... **Steven R. Lerman**, '72, SM '73, PhD '75, has been named the Class of 1922



S.R. Lerman

Professor for a five-year term. When the members of the class of 1922 established the professorship that bears their name, their intention was to recognize and support the teaching of students rather than activities devoted solely to research. Lerman, the first director of Project Athena, is now director of the Center for Educational Computing Initiatives, which is pursuing many initiatives launched under Project Athena. He also chairs the Academic Computing Council, a focal point for educational computing needs of the faculty, and is director of the Department's Intelligent Engineering Systems Laboratory. ... **M. David Egan**, SM '66, Clemson University professor, reports: "Architectural Acoustics, published by McGraw-Hill Book Co. in 1988, will be translated into Japanese by Kajima Institute in Tokyo. This will be the fifth foreign language edition of my technical books for architects and engineers." ... **Luis Javier Mira**, SM '72, sends word: "I am lecturing at the Universidad de Los Andes in the Industrial Engineering Department in Bogotá, Colombia. I teach courses in project evaluation and actuarial theory, and a seminar on social ethics." ... From

Orinda, Calif., **Ulrich Luscher**, SM '59, ScD '63, writes: "As part of a reorganization at Woodward-Clyde into a matrix structure, I became one of a select group of six corporate senior consultants. The individuals and the group participate in key projects and proposals throughout the company." ... **David E. Langseth**, SM '80, ScD '83, has been named VP at Arthur D. Little, Inc. Previously he was a consultant for the Cambridge-based firm. ... **Peter S. Eagleson**, ScD '56, the Edmund K. Turner Professor of Civil Engineering and a leading expert

on the global hydrologic cycle, delivered the annual Nolan Lecture sponsored by the Department of the Interior's U.S. Geological Survey at the USGS's National Center in Reston, Va. The lecture, in honor of Thomas B. Nolan, former USGS director, is given by a scientist whose research has led to significant advances in the earth sciences. Eagleson spoke on the importance of continental evapo-transpiration of water in the global hydrologic cycle and reviewed recent developments in representing continental precipitation and evapo-transpiration in global-scale models.

Frank E. Perkins, '55, SM '59, ScD '66, dean of the Graduate School, has been elected VP and president-elect of the Association of Graduate Schools, an institution that is part of the Association of American Universities. Perkins will be VP until October 1992 and then serve a one-year term as president of the AGS. The organization provides a forum for the exchange of information on doctoral education for its 58 graduate school dean members. Perkins is noted for applying computers to problems in hydrology and civil engineering. ... **Kayle L. Brubaker**, SM '91, a Course I graduate student, has won the Atmospheric Sciences Section Outstanding Student Paper (Oral) Award for her presentation at the Spring 1991 meeting of the American Geophysical Union. ... **Lee R. Krumholz**, has been appointed an Esther and Harold Edgerton Assistant Professor for a two-year term. Krumholz' research is conducted at the Department's Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics. His research focus is on microbial degradation of organic pollutants and transformation of inorganic pollutants in the environment. He is teaching in the area of environmental microbiology.

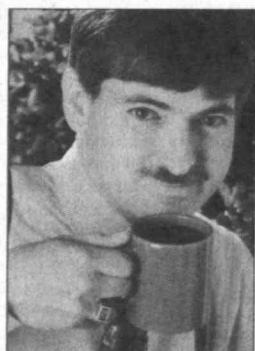
MIT was well represented at the awards luncheon at the Transportation Research Forum's annual meeting in New Orleans. **Carl D. Martland**, '68 (XVIII), SM '72, CE '72, senior research associate in the Department and a past president of the forum, received the Herbert O. Whitten Award "in appreciation for years of outstanding service and dedication" to the organization. Martland also was a co-author of the paper selected for the \$2,500 award as best paper presented to the conference, entitled "Alternative Freight Car Maintenance Policies with Attractive Reliability/Cost Relationships." The paper also won the \$1,500 Conrail Award for the best rail paper presented to the conference, making it three straight years that Martland has won this award. The prize-winning paper was based on a dissertation by **Patrick Little**, SM '82, ScD '91, who has an adjunct appointment on the research staff. The third co-author was MIT Professor **Joseph Sussman**, PhD '68, who supervised Little's dissertation. **Ann Yablonski**, SM '91, won the \$200 second place award in the Transportation Research Forum's student paper contest for her paper, "A Study of Design Parameters of Advanced Driver Information Systems." ... **James W. Mar**, '41, SM '47, ScD '49, Course XVI professor emeritus, has been elected a 1992 Honorary Fellow of the American Institute of Aeronautics and Astronautics for "eminent, long-standing contributions in the fields of structures, aeroelasticity, and materials, and for internationally renowned leadership in aerospace engineering for government, industry, and academia."

Fred Salvucci, '61, the civil engineer featured in the article that begins on page MIT 6, says he entered high school thinking that he would quit at 16 and be a bricklayer, like his father. But his parents had other ideas: "Construction workers always want their kids to be engineers." So he came to MIT. But he did his bricklayer's apprenticeship as well, for which the fireplace at left met one requirement, and he worked construction during the summers of his college years.



II MECHANICAL ENGINEERING

From Plano, Tex., **Richard G. Keck**, SM '84, PhD '87, writes: "I am currently technical coordinator of hydraulic fracturing research for Arco Oil & Gas Co. and the chairman of the American Petroleum Institute Subcommittee on Fracturing Fluid Rheology, which is developing an industry standard testing procedure." . . . **Bulent Platin**, SM '72, ScD '78, reports: "In September 1990 I returned to the Mechanical Engineering Department at the Middle East Technical University in Ankara, Turkey, after spending a two-year sabbatical leave at the University of Connecticut at Storrs as a Fulbright Research Scholar and visiting professor. I was promoted to full professor last spring. I have been serving as the assistant chair of the ME department at my home institution for more than 1 year." . . . **James H. Goldie**, SM '82, announces the birth of his third child, Samuel



R.H. Johnson & his Brass Rat

showed my 'brass rat.' It's been fun hearing comments from alumnae."

Louis C. Kuttruff, SM '47, is a staff engineer at Exxon Chemicals America in Baton Rouge, La. . . . From Milwaukee, Wis., **Fred Landis**, SM '49, ScD '50, reports: "I have been elected VP of the Basic Engineering Group of ASME for the 1992-94 term." . . . **William T. Townsend**, SM '84, PhD '88, writes: "I am working for two companies in Cambridge, both growing and doing well despite the recession. I serve as president of Barrett Technology, Inc., which manufactures and sells robotic equipment based on MIT-patented technology. I also serve as chair of Barrett Design, Inc., a marketing firm managed by my wife, Julie Townsend." . . . From Bozeman, Mont., **Sidney A. Whitt**, SM '37, sends word: "I would be happy to have any former classmates of Course II '34 stop by for venison steaks. We live 80 miles north of Yellowstone Park. My wife, Millicent Ward Whitt (Smith, '32), and I still enjoy the Big Sky Country. I finally retired from SUNY as professor emeritus." . . . **Lawrence S. Daniels**, SM '66, has been named VP for marketing and business development at Biogen, Inc., in Cambridge. He will be responsible for Biogen's business development, strategic planning, and general commercial activities worldwide. Formerly, Daniels was with Allied Signal, Inc., in Morristown, N.J., where he had been VP for corporate strategy development.

Howard J. Rosenberg, SM '83, reports: "I launched my own management consulting company, RCT Management Group to help manufacturing companies to become more competitive." . . . **William M. Hou**, SM '87, writes: "I relocated to Parsippany, N.J., and am working for G.E. Medical Systems as area service manager for the New York region." . . . From Lexington, Mass., **Ravinder K. Sakhuja**, SM '68, ScD '71, writes: "I am president of Tecogen, Inc., a company involved with manufacturing packaged cogeneration systems and gas-fired air conditioning systems. The

company also performs new-product development under contract from the gas industry and Department of Energy. These products use advanced automotive-derived, low emission, natural-gas-burning engines." . . . **W. C. Menzies, Jr.**, SM '55, sends word from Charlotte, N.C.: "I completed a volunteer assignment to the Crescent Jute Corp. of Faisalabad, Pakistan, for the International Executive Service Corps. My wife, Mary Frances, did volunteer work at two schools in Faisalabad. We were there from October 12, 1991 to December 13, 1991." . . . **Beal Marks**, SM '47, writes: "I work as resident engineer (part-time) at the local airport. I have been interested in airplanes and flight all my life. I formed a local 'Crystal Coast Radio Control Club' five years ago and have a stable of eight R/C planes, two R/C gliders, and lots of interesting characters to fly with—it's a great hobby!"

From **Dwight E. Beach, Jr.**, SM '65, in Houston: "We are involved in worldwide sales and rentals of drilling tools in the oil and gas industry. In 1991 we did business in Scotland, Norway, Holland, Denmark, Germany, France, Venezuela, Bolivia, Brazil, Colombia, Mauritania, Nigeria, Algeria, Congo, South Africa, Gabon, Madagascar, Brunei, and Australia." . . . **Leon Sealey**, SM '48, retired from General Electric in December 1985. . . . **Steven Manzi**, SM '77, sends word: "I am currently a senior product designer for Apple Computer Co. in Cupertino, Calif. My wife, Joanne, our son, Brennan, and our daughter, Stephanie, are also living in Cupertino as of July 1991." . . . **John J. Eige**, SM '55, writes: "I retired from IBM in 1991. I'm living in San Jose, Calif., and enjoying family activities, traveling, and painting." . . . **L. Stephen Wolfe**, SM '72, sends word: "I am publisher of *Computer Aided Design Report*, now 10 years old, and the leading independent newsletter on CAD. In 1991 I became publisher of a new newsletter called *Rapid Prototyping Report*." . . . **Benjamin B. "Bo" Stokes III**, SM '63, reports: "I have accepted an appointment representing the United States with a recently established operation of NATO. I will be living in Brussels, Belgium, assigned to NATO headquarters, to work with the newly created NATO Insensitive Munitions Information Center as a propulsion technical officer. My appointment is for three years, beginning last January." . . . **Adrian Bejan**, '71, SM '72, PhD '75, sends word: "Springer Verlag just published my book, *Convection in Porous Media*, which I wrote with D. A. Nield. My three earlier books were published by John Wiley & Sons: *Advanced Engineering Thermodynamics* (1988), *Convection Heat Transfer* (1984), and *Entropy Generation through Heat and Fluid Flow* (1982)."

Harvard B. Kolm, SM '55, was recently profiled in a two-page spread in the October 1991 issue of *Western New York*. In the article, Kolm, who is president of HSC Controls, Inc., discusses his career, his service in the Royal Canadian Navy Reserve, and his passion for sailing. . . . **Samuel**



S.M. Tennant

"having provided seven presidents with powerful defense capabilities—ballistic missile systems, sophisticated space systems, and satellite control systems. In the last 30 years, these capabilities played a key role in maintaining America's posi-

tion of strength and in making our policy of strategic deterrence work." . . . **Erwin G. Loewen**, SM '49, ME '50, ScD '52, professor at the Institute of Optics at the University of Rochester, and VP for R&D and engineering at the Milton Roy Co., has been selected to receive the Leo H. East Award as the 1991 Engineer of the Year. He was supported for the award by the Rochester Section of the Optical Society of America. Loewen was responsible for the development of a recognized state-of-the-art Scale and Grid Ruling Engine while department manager and director of Gratings and Metrology at Bausch and Lomb. In addition he is an internationally recognized authority in the fields of metal-cutting, precision engineering and machining, and theory and fabrication of different gratings.

Je-Chin Han, ScD '77, professor of mechanical engineering at Texas A&M University in College Station, and **E. Bjorn Qvale**, '62, SM '63, PhD '67, professor of energetics at the Technical University of Denmark in Lyngby, have been elected Fellows of ASME. Han was cited for "pioneering work in angled rib-type turbulence promoters for aircraft gas turbine engines, which have recently become the standard in advanced turbine airfoil cooling systems. His technical contributions focus on convective heat transfer, including heat transfer augmentation in turbine blade cooling and high turbulence film cooling. Qvale was cited for "his research on water-driven pumps and systems for pulverized coal-handling, aquifer thermal energy storage, and energy efficiency in refrigeration and air conditioning equipment and city buses. His thesis on the harmonic analysis of Stirling cycles established a new direction in the practical design analysis of these cycles. It has served as a starting point for a continuing series of thesis projects on refrigeration and power cycles employing heat transfer components with oscillating pressure."

Miklos Sajben, ScD '64, of the McDonnell Douglas Research Labs, in St. Louis, Mo., and **M. Michael Yovanovich**, ME '66, ScD '67, professor of mechanical engineering at the University of Waterloo, in Ontario, have been elected 1992 Fellows of the American Institute of Aeronautics and Astronautics. . . . **Robert C. Dean, Jr.**, '48, SM '49, ScD '54, president of Dean Technology, Inc., was a member of an NAE Study Committee that contributed to *Profiting from Innovation: The Report of the Three-Year Study from the National Academy of Engineering* (The Free Press, 1991). According to a publisher's press release, the book, edited by William G. Howard, Jr., and Bruce R. Guile, "demonstrates how companies can transform new ideas into products efficiently and systematically by removing the barriers that surround innovative technology." . . . **Darryl K. Robinson**, '86, has been named by *Urban Profile* magazine as one of the nation's leading young blacks. Robinson, president of Robótica Automation Consultants of Boston, was assigned fifth place in a listing of "30 Under Thirty" black achievers. The magazine said that Robinson "left the security of the corporate world to strike out on his own" at Robótica, a computer consulting firm that helps clients of all sizes to profit from computers. "Entrepreneurship is the only route to financial independence," Robinson told the magazine. "We as blacks have to start owning things before we can control our own community."

Former Dean of Engineering **Gerald L. Wilson**, '61, SM '63 (VI), ScD '65, has been named VP for corporate technology and manufacturing at Carrier Corp. in Farmington, Conn. He will direct the overall engineering, reliability, and advanced technology and manufacturing there while on extended leave from MIT. . . . **James H. Williams, Jr.**, '67, SM '68, frequently recognized in student course evaluation guides as one of MIT's premier teachers, has been appointed to the School of Engineering's Professorship in Teaching Excellence. The professorship was established by an anonymous gift to recognize teaching excellence

and to support educational program development. The appointment is for a five-year term. Assessments by both students and colleagues have cited the intellectual rigor of his teaching, his lucid presentations, high expectations, and excellent results. He is also known for his commitment to minority student development and to increasing the presence of minority faculty at MIT. . . . **Jung-Hoon Chun**, PhD '84, has been appointed to an Esther and Harold Edgerton Assistant Professorship for two years. Chun is interested in innovative and interdisciplinary approaches to manufacturing, particularly in the area of materials processing and metal-matrix composites.

Edmund L. Czapek, SM '46, of Quaker Hill, Conn., died on October 31, 1991. He had retired as chief of radiation analysis at Electric Boat in 1987 after 36 years with the company. While at MIT during World War II, he worked on radar research. From 1957-1959, he was the organizer and lecturer for the shield design course at Electric Boat. From 1960-1971, he lectured at the University of Connecticut on advanced graduate mechanical engineering courses.

III MATERIALS SCIENCE AND ENGINEERING

Maurice E. Shank, ScD '49, writes: "I retired from Pratt & Whitney, United Technologies at the end of 1987. I live in the Seattle suburb of Bellevue, Wash., in winter and in York Harbor, Maine, in summer, since we have children and grandchildren on both coasts. I am consulting in aerospace and serving as a member of the Aeronautics and Space Engineering Board of the National Research Council." . . . **Aziz I. Asphahani**, PhD '75, and his colleagues, Paul Crook and Steve Matthews, of Haynes International, Inc., were honored by *Research & Development* magazine for winning the 1991 "R&D 100" Award for the "Ultimet Alloy." Each year, the magazine gives awards to the 100 most significant new technologies of the year. The Ultimet alloy was selected on the basis of its innovative design as the most advanced corrosion- and wear-resistant alloy.

R. Winston Revie, PhD '72, of Ottawa, Ont., is organizing the International Conference on Pipeline Reliability, to be held June 2-5, 1992, at the Calgary Convention Center in Calgary, Alberta, Canada. . . . **Hiroshi Menjo**, SM '85, writes: "I have recently joined AZCA, Inc., a Redwood City, Calif.-based international management consulting firm that specializes in new business development between the U.S. and Asian countries, primarily Japan, in the high technology field. My experiences in materials science at MIT and in management consulting at the Boston Consulting Group (Tokyo) combine to serve U.S. high tech ventures in achieving their particular new business objectives, which often involve a technology license, joint venture, R&D partnership, or similar arrangements."

George Foo, ScD '77, is currently the manufacturing and engineering director at AT&T's Little Rock factory, which manufactures network computing products. . . . **Jack P. Salerno**, PhD '83, announces the birth of twin daughters, Katie and Julie, born August 12, 1991. He has another daughter, Jennifer, who is almost 4. . . . **Diran Apelian**, ScD '73, provost and Howmet Professor of Engineering at Worcester Polytechnic Institute, has been recognized as the Champion H. Mathewson Gold Medal recipient at the 1992 Annual Meeting & Exhibition of The Minerals, Metals, & Materials Society. The medal is awarded for a paper or series of papers that represents a notable contribution to metallurgical science. Apelian is being recognized for a series of three papers published in *Metallurgical Transactions B* on the plasma processing of materials and near net shape casting. . . . Course III Professor **Kirk D. Kolenbrander** has been selected as a Carl Richard

Soderberg Professor in Engineering. The chair supports researchers whose work is important to the development of power systems. Kolenbrander's research involves synthesis, processing, and characterization of new quantum confined semiconductor nanocluster materials that exhibit novel photonic and electronic properties. These properties may lead to important applications in high-speed optical switching networks and in the fabrication of high-power solid-state laser systems. . . . **Marc H. Richman**, '57, ScD '63, professor of engineering at Brown University and president of



M.H. Richman

Fellow. Richman has been teaching at Brown since 1963, and has been in forensic engineering since 1957.

Dorothy Hosler, who holds a joint appointment in the Anthropology / Archaeology Program and the Center for Materials Research in Archaeology and Ethnology, has been appointed an Esther and Harold Edgerton Assistant Professor for a two-year term. Hosler, a faculty member since 1989, combines research in materials science and engineering and archaeology. In addition to her joint appointment, she is also a Course III lecturer. Her laboratory research and archaeological fieldwork focus on the metallurgical and ceramic production technologies of ancient, New World societies. While using finite element analysis to study the engineering design of artifacts, she also carries out ethnographic fieldwork among nonindustrial communities in Latin America to understand how culture places constraints on the processing and management of materials.

Andreas Mortensen, PhD '86, the Alcoa Associate Professor of Mechanical Metallurgy, and **Veronique J. Michaud**, PhD '91, postdoctoral research associate, both from Course III, have been chosen to receive the 1991 Marcus A. Grossmann Young Author Award from ASM International. Their paper "Infiltration of Fiber Preforms by a Binary Alloy: Part I Theory," was published in the July 1990 issue of *Metallurgical Transactions A*. . . . Course III Professor **John B. Vander Sande** has been named the Cecil and Ida Green Distinguished Professor, the first faculty member to be so appointed. This five-year chair is the tenth professorship to be established by the Cecil Green estate. Vander Sande, who has been with the Institute since 1971, began his career as a metallurgist who used electron microscopy to explore atomic-scale kinetic and defect phenomena in physical metallurgy. He later broadened his scope to other classes of materials—ceramics, polymers, and glasses as well as metals. Most recently he has addressed issues surrounding the processing of high-temperature superconducting oxides into wire forms for ultimate use as magnets and motors. His contributions in these areas have been hailed by specialists. He later conceived and established the first dedicated scanning transmission electron microscope in the United States oriented toward materials science.

The Association of Alumni and Alumnae has been notified that **Maurice C. M. Grandpierre**, SM '50, of Nancy, France, died on September 5, 1991. There was no further information provided.

IV ARCHITECTURE

Robert S. Allan, MAR '55, sends word from Irving, Tex.: "I am very fortunate to be starting the 25th year of private architectural practice—trying to design buildings flexible enough to accommodate the new ideas of the next century. Teaching part-time at two local universities helps to generate new ideas. We just completed the design for a memorial bell tower with an open air chapel in its base for Texas Gulf Coast. Correspondence or calls from classmates would be welcomed." . . . From Fort Meyers, Fla., **Robert R. Ferens**, MAR '48, writes: "I really enjoy the monthly meetings of the MIT Club of Southwest Florida, usually held in Sarasota. I appreciate those who come all the way down from Cambridge to inform us about what is happening back there at Tech. We have a vital group here and it is always wonderful to see so many red jackets participating so fully. I'm from the class of '48, and they still consider me a youngster!" . . . **Mario O. Bourgois**, SM '90, reports: "I am currently employed at Thinking Machines Corp. in Cambridge, and am working on their supercomputer project, the CM-5." . . . **Peter Droege**, MAA '78, has accepted the position of urban development and design advisor to the City of Amsterdam. . . . **Stephen Carr**, MAR '61, writes: "I am president of Carr, Lynch, Hack, and Sandell, a Cambridge-based firm practicing architecture, landscape architecture, urban design, and planning. In the past five years the firm has replanned the Hudson River waterfront in New York, designed a large park at Battery Park City, replanned Boston's Prudential Center, and designed various commercial, residential, and resort buildings. Current work includes a park design for extending Boston's Charles River Basin; a design for the central waterfront of Perth, Australia, won an international competition." . . . **Demetrios A. Criezis**, MAA '77, and **Susan Schneider-Criezis**, MAA '78, are taking their company international with the formation of Criezis Architects International in Athens, Greece. They plan to use the office as the base for European operations. . . . From Somerville, Mass., **Marc Maxwell**, MAR '85, reports: "Having founded my own consulting firm in 1990, I have persevered through 1991 successfully—providing planning, facility programming, and architectural design services to a wide variety of public and private clients. New clients in 1991 included Springhouse, a 100-unit congregate facility to be built in Boston, Fenway Community Health Center, the Sterling Care Group of Louisville, Ky., developing a number of residential Alzheimer care facilities, and 3M in Cambridge, where we renovated existing facilities." . . . **Joanna Frost-Golino**, MAR '75, sends word: "I am a registered architect in the State of Florida. I am presently practicing in Palm Beach and am serving on the Architectural Commission for the town of Palm Beach. I am a member of the American Institute of Architects as well as a member of the MIT Club of Palm Beach County." . . . The Ostomy Association of Boston has conferred its Outstanding Service Award for 1991 on **Edward Baron Turk**, professor of French and film studies in the Foreign Languages and Literatures Section at MIT, for his involvement in the work of the group. The volunteer nonprofit organization serves the needs of individuals who undergo surgery resulting in a colostomy, ileostomy, or urostomy. These surgeries are typically required when the bowel or bladder does not function properly. From 1987 to 1991, Turk has been a member of the association's board of directors and its chair of education, providing educational programs to physicians, social workers, and other health professionals. In giving the award to Turk, who has had an ileostomy since 1979, the association cited his commitment to the ideals of humanitarian services that bind

No Quantity Discount in Chemical Waste Disposal!

Chemists are well-acquainted with the concept of "value-added." With their ingenuity, intuition, and training, they take relatively inexpensive materials and create usefulness and value. From nylon to Teflon, from cosmetics to cooking, the rewards for creativity are large. But nowadays, more "value" is added at the disposal end, though not by the chemists.

For example, "it costs \$32 to dispose of a gallon of benzene that can currently be purchased for only \$15," says MIT Professor of Chemistry Rick L. Danheiser. This new reality, he says, calls for a totally new way of thinking for chemists. "To start at the source, we'd like our faculty to borrow more from one another and buy smaller quantities. 'Larger is cheaper' is no longer true." at least in the long run." Another facet of reality is MIT's reluctance to pick up the tab for large-scale cleanups of labs left intact by departing researchers. "There were sizable collections of chemicals that were no longer needed, but not totally useless either, says Danheiser. "Redistribution seemed preferable to disposal—and cheaper, too."

To deal with both issues, Danheiser came up with the idea of a centralized exchange—the Excess Chemical Exchange and Disposal Holiday. "Actually, it was three days [in April 1990]. During the week before the holiday, we collected into one room 9,386 bottles. Only the Group Safety Officers were authorized to drop off chemicals, which were organized into alphabetical order. Then, during the week, we redistributed 848 bottles to the same groups. People came, browsed, and took what they wanted."

With the cream presumably skimmed, Danheiser worked on the

remainder. "We negotiated with Laboratory Supplies at the Institute. They have set aside space to transfer up to 1,500 bottles of chemicals that people are likely to want." These items are available, in the strange-speak of accounting, for "purchase at no charge."

While the Exchange and Disposal Holiday was a one-time event, the program continues. People with excess chemicals still bring them to Danheiser, who determines which ones can go to Lab Supplies. The Safety Office disposes of the rest in the normal way. The plan "has turned out to be a remarkable success," says Danheiser, "that far exceeded our expectations. We've made the department safer and saved money, both in purchase and disposal costs."

The effort has paid other dividends as well. As a result of the department's hygiene and safety program, of which the Excess Chemical Exchange and Disposal Program is a part, the American Chemical Society Division of Chemical Health and Safety awarded the Department of Chemistry its 1991 College Safety Award, which consists of a plaque and a \$1,000 prize to support chemistry's safety programs. Other aspects of that program, documented in the department's "Chemical Hygiene Plan," include required attendance at a two-hour chemical hygiene lecture or video for all new students and researchers, a special safety training session for teaching assistants at the beginning of their appointment at MIT, the establishment of a Library of Lab Safety, and periodical distribution of "Chemical Research Safety Notes." —David Andrews, '66 □

The author is a biochemist living in Concord, Mass.



our membership in a common mission."... Matthew Turk, PhD '91, and Alexander P. Pentland, PhD '82 (IX), of the MIT Media Lab's Vision and Modeling group, won an IEEE Computer Society Outstanding Paper Award at the 1991 Computer Vision and Pattern Recognition Conference last June. Pentland is associate professor of computers, communication, and design technology, and NEC Career Development Professor of Computers and Communications.

V CHEMISTRY

From Chagrin Falls, Ohio, Byron G. Hays, PhD '64, reports: "In January I started work as a senior research associate for Engelhard Corp. in Beachwood, Ohio."... George A. Frank, PhD '65, writes: "This past February I was promoted to the rank of corporate counsel in DuPont's Legal Department. This is the highest professional level for a lawyer at DuPont."... Steven E. Hall, PhD '82, has been promoted to associate director of the Cardiovascular Chemistry Department at the Bristol-Myers Squibb Research Institute. He is responsible for anti-thrombotic and anti-ischemic programs. ... Steven J. Gould, PhD '70, was awarded the Milton Harris Basic Research Award for 1991 from Oregon State University, where he is a professor in the Department of Chemistry. ... From Boothwyn, Pa., Robert R. Luise, PhD '70, writes: "I have been elected to the Board of Directors of the MIT Association of Alumni and Alumnae for 1992-94, as district director #5, representing Pennsylvania, Delaware, and Central South New Jersey."... Alfred C. Haven, PhD '50, reports: "I retired 10 years ago from DuPont, Co., after various assignment in R&D management and international division. I'm now active in town affairs on Cape Cod, currently serving as selectman."... Ned M. Weinshenker, PhD '69, was elected CEO of Iomed, Inc., a medical device and drug delivery systems company in Salt Lake City, this past January. ... Timothy P. Curran, PhD '88, assistant professor of chemistry at Holy Cross College in Worcester, Mass., has been named a full-time faculty member. ... Sylvia T. Ceyer, Course V professor, has been named the first holder of the W.M. Keck Foundation Professorship in the field of energy. The five-year professorship was established last June with a grant of \$1.5 million from the W.M. Keck Foundation of Los Angeles. Ceyer's internationally recognized research in surface chemistry has important applications in the conversion of natural gas to useable fuels. Her research into the dynamics of molecule-surface interactions has resulted in the observation of new mechanisms for dissociative chemisorption, desorption and absorption, and surface reactions. Her work also extended the understanding of molecular precursors, identified and clarified the site conversion process and provided a novel method for adsorbate synthesis. Ceyer received the Baker Award for Undergraduate Teaching in 1988 and MIT's Edgerton Prize for junior faculty in 1987. She has also been the holder of the Class of 1953 Career Development Chair.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

From Lafayette, La., Benjamin J. Leon, SM '57, ScD '59, writes: "I joined the faculty of the University of Southwestern Louisiana to start up an interdisciplinary program in telecommunications involving electrical and computer engineering, business administration, and political science (public policy). After a year of processing, we have started the MS with the authorization of the State Board of Regents. We have six EE and CE faculty, two from business administration, one from political science, plus one from communica-

tions. We hope to expand to the PhD." ... **Donald K. Ross**, SM '48, chair and CEO at Ross & Baruzzini, Inc., of St. Louis, Mo., has been named a Fellow of the IEEE. Ross was cited for "contributions to the technology of energy conservation in



D.K. Ross

illumination systems." Ross has gained national prominence for his work in energy conservation and in redefining light standards. His achievements include the development of a new approach to task lighting that reduces energy consumption by 25 to 40 percent without compromising worker performance, comfort, or health, according to a news release. ... **Casimir M. Wierzynski**, a Course VI student slated to receive both an SB and SM this June, has been awarded a Marshall Scholarship, allowing him to study at a British university for two years free of charge. Wierzynski will study toward a bachelor's degree in economics at Cambridge University, with the intention of eventually helping formulate public policy in technology. Marshall Scholarships, awarded annually since 1953, are Britain's official gesture of thanks to the U.S. for aid received after WWII under the Marshall Plan. The scholarships, which are paid for by the British government, are worth about \$22,000 per year, and cover tuition, books, travel, and living expenses.

Gordon K. Harris, Jr., SM '66, is a patent attorney with Harness, Dickey, & Pierce in Troy, Michigan. He received a JD in 1977 from Ohio State University. ... **Fred I. Diamond**, '50, chief



F.I. Diamond

scientist at the U.S. Air Force Rome Air Development Center, has been honored by President Bush as a recipient of the 1991 Presidential Rank Awards. Diamond received the Distinguished Rank Award of \$20,000, the highest award bestowed in the Senior Executive Service. "During Diamond's 40 years as a scientist and engineer for the DOD, his vision and innovation have resulted in major initiatives in areas identified by the department as Critical Technologies. He has contributed to major improvements in radar and communications, improvements which are now incorporated into our nation's operational defense systems," states a government news release. ... **John M. Cochran, Jr.**, SM '64, is president of Highland Yarn Mills, Inc., in High Point, N.C. ... **Stanley P. Lapin**, SM '47, is president of the St. Thomas and San Juan Telephone Co., in the U.S. Virgin Islands and the STSJ Overseas Telephone Co. in Puerto Rico. ... **Adrian R. Hartman**, SM '66, EE '67, PhD '71, sends word: "I direct a core technology center for wireless and cellular communications with emphasis on premises and terminal equipment technology at the AT&T Bell Labs located in Whippany, N.J." ... From **Robert W. Rasche**, SM '60: "I am project manager at the University of Arizona's Steward Observatory—designing and building a second generation instrument to be installed on orbit into the Hubble Space Telescope in 1997." ... **Arlyn W. Boekelheide**, SM '52, writes that he is looking forward to attending his 40th class reunion this year. ... **Paul J. Shaver**, SM '62, ScD '65, has been named president of EG&G Vactec, in St. Louis, Mo., a major manufacturer of photodiodes, photo-

Water Testing While You Wait

Suppose you and your neighbors suspect that there is a leak from the underground tank at a nearby service station or that leachates from a landfill are contaminating your wells. Once you manage to prod local authorities into action, a drilling rig is dispatched to the site. Using an eight-inch auger, the machine drills a series of test wells, all around the tank or landfill. But because the auger churns up the earth, it's impossible to take a representative water sample right away; the aquifer has to settle for one to two weeks. What's more, the screw action of the auger brings soil up to the surface, along with toxic substances that could require sophisticated and expensive disposal. Finally, a technician returns and takes water samples from each well and sends them off to a laboratory. About two weeks after the original drilling date, you may have the information you need to assess the problem. However, initial test results frequently are not adequate and the entire process must be repeated, perhaps several times.

Your local authorities could save time and money by calling on Pine & Swallow Associates and the VibraDrill—invented by John Swallow, PhD '74. The VibraDrill is a self-propelled, self-contained drilling and testing rig, which employs a high frequency driver to vibrate, rather than rotate, small-bore (3/4 inch) steel pipe, driving it to depths of over 100 feet. The driver's energy sets the soil particles in motion, allowing the VibraDrill to penetrate more easily. When the closed-end slotted pipe, called a MicroWell, reaches a predetermined test depth, a small pump purges the well and samples the ground water. Analyses are completed in 10 minutes in an on-site mobile lab. Volatile organic compounds can be detected down to 50 parts per trillion. Deeper water samples can be

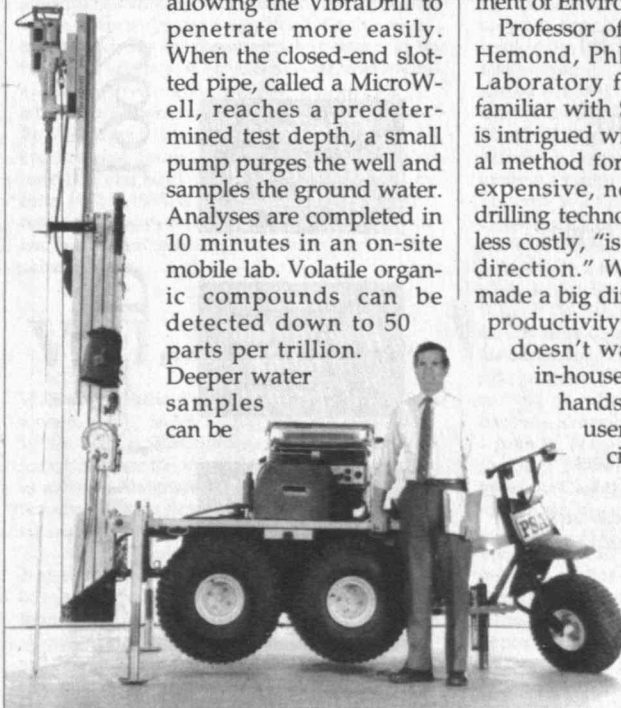
tested by drilling the same MicroWell farther into the aquifer or multiple locations can be tested to provide a more complete picture. Up to 17 wells have been installed in one day by a two-person team. MicroWells can be left as permanent monitoring wells or removed after sampling.

No settling time, no waiting for lab results, and—particularly important for Superfund and radioactive-waste sites—no piles of toxic soil to be disposed of. A day's work with the VibraDrill can produce a profile of the aquifer, showing—for example—where and in what concentrations it is carrying toxic substances and where the source is located. Although studying ground water for contamination is the most common application to date, the VibraDrill works just as well in studying potential production well sites.

Swallow is an environmental chemist, and seven years after completing a doctorate at MIT, he and geotechnical engineer Robert Pine launched Pine & Swallow, an environmental consulting firm based in Groton, Mass. In the course of assessing contaminated sites, determining liability, providing expert testimony, and carrying out clean-ups, they were frustrated by the expense and delays of traditional groundwater testing. They developed the VibraDrill to solve their own problems, and it won for them the 1991 New England Environmental Award from the EPA and the Massachusetts Department of Environmental Protection.

Professor of Civil Engineering Harry Hemond, PhD '74, of MIT's Parsons Laboratory for Water Resources, is familiar with Swallow's VibraDrill and is intrigued with the idea. The traditional method for testing ground water is expensive, notes Hemond; this new drilling technology, which is faster and less costly, "is a viable step in the right direction." While the VibraDrill has made a big difference in his company's productivity and efficiency, Swallow doesn't want to keep the machine in-house. He'd like to see it in the hands of as many commercial users and government agencies as possible. "If we can make it cheaper and easier to detect and treat groundwater contamination, we increase the chances that all water supplies will be protected," he says.

—Sherrie Saint John □



Business
&
EducationCultural Values,
Individuals &
OrganizationsRegulation
&
Public PolicyOrganizational
Structure &
Design

ISSUES AND SPEAKERS

Internationally, America is no longer the richest or best educated nation. Domestically, traditional boundaries between business organizations, government, and the educational system are in flux. Competitive American participation in the world economy is dependent upon, among other things, the relationship between the individual to the work place, the structure of work, and the interactions of the educational system with the business organization.



Come share your thoughts on these issues with the likes of Lester Thurow, Dean of the Sloan School, Phil Khoury, Dean of the School of Humanities and Social Sciences, Joel Moses MA '67, Dean of the School of Engineering, Paul Gray '54 EE, Chairman of the Corporation, and Suzanne Berger, Department Head of Political Science. All eagerly await your participation in Technology Day '92.

Winds of Change:

*Achieving Global Business Excellence
for America
in the 21st Century*

THE SCHEDULE

8:15 am

Memorial Service in the MIT
Chapel

9:00 am

Technology Day program begins
in Kresge Auditorium

12:30 pm

Lunch begins in the Athletic
Center (\$17)

3:00 pm

Concurrent Panel Discussions

*The topics of the morning will be
debated in detail with provocateurs
and moderators inviting alumni to
participate.*

5:30 pm

Deans' Reception (\$12.50)

*Graduate
Alumni/ac
Welcome!*

*More
information
to follow
in the mail*

*Questions?
Call (617)
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cells, and optoelectronic sensors.

The Foundation for a Creative America recently honored **W. Daniel Hillis**, '78, SM '81, PhD '88,



W.D. Hillis

founder of the Foundation for a Creative America, founding scientist of Thinking Machines Corp. and architect of the Connection Machine Super-computer, with its 1991 "Spirit of American Creativity" award. The annual award recognizes individuals whose "creative contributions in the areas of invention and creative arts are a singular part of American life in the 20th Century." Hillis concentrates his research on methods of parallel programming, applications of parallel computers, and computer architecture. According to a foundation news release, "The Foundation for a Creative America is a not-for-profit educational organization formed in 1988 by members of the United States intellectual property bar in cooperation with the federal agencies responsible for the U.S. intellectual property systems—the Office of Copyrights, Library of Congress, and the U.S. Patent and Trademark Office. The foundation's exhibits, publications, and programs are designed to broaden awareness of patent and copyright laws and to foster creativity under the protection and encouragement provided by the U.S. patent and copyright systems." . . . **Martin A. Schmidt**, SM '83, PhD '88, has been selected as a Carl Richard Soderberg Professor in Engineering. The chair supports researchers whose work is important to the development of power systems. Schmidt's work with bonding silicon wafers has important potential for power-integrated circuits. In addition, he is applying this technology in micromachined sensors and actuators that can be used in process control, automotive, medical, and consumer applications. . . . Former Dean of Engineering **Gerald L. Wilson**, '61, SM '63, ScD '65 (II), has been named VP for corporate technology and manufacturing at Carrier Corp. in Farmington, Conn. He will direct the overall engineering, reliability, and advanced technology and manufacturing while there on extended leave from MIT. . . . The Society of Motion Picture and Television Engineers has elected Professor Emeritus **William F. Schreiber** a Fellow of the organization for his contributions to image coding systems, color processing, interactive color editing systems, and color correction for graphic arts. "The color system developed at MIT is now the standard in desktop publishing," the Society said in its announcement. Schreiber, a member of the EECS faculty, was director of the Advanced Television Research Program from 1981-89 where he developed the MIT-CC HDTV system.

Richard C. Larson, '65, SM '67, EE '67, PhD '69, a noted expert in operations research, especially as applied to urban and public systems, has been named a co-director of the Operations Research Center. He succeeds **Amedeo R. Odoni**, '65, SM '67, PhD '69, who has been co-director since 1986 with **Thomas L. Magnanti**, who will continue as co-director. Odoni will maintain his teaching and research at MIT in operations research. Larson, who served as co-director of the ORC from 1977-86, has been a member of the MIT faculty since 1969. He is recognized as a distinguished researcher and educator whose fields of specialization include the applications of operations research to private and public logistical systems, including queueing theory and the psychology of queues. His recent work on the psychology of queues has received wide attention in both the academic community and the public and has been featured in reports on television, radio, and in the press (See *Technology Review*, July 1988, p. 60). . . .

John Savage, '61, SM '62, PhD '65, professor of computer science at Brown University in Providence, R.I., has been named a member of the MIT Corporation's Visiting Committee for EECS. Savage, one of 18 chosen committee members, will serve through 1992.

Ralph J. Bahnsen, ScD '65, of Wappingers Falls, N.Y., died on June 16, 1991. Bahnsen was an electrical engineer on the senior technical staff at IBM Poughkeepsie, where he worked for 38 years. He was a member of the IBM Quarter Century Club, the national chapter of the IEEE, Sigma Xi, the Sierra Club, and the Lake Champlain Committee.

VI-A INTERNSHIP PROGRAM

At this writing, the first of February, thus far the winter has not brought a major snowfall to the Boston area. Several passing coastal storms have brought high winds (with wind chill factors below zero), but they've passed sufficiently far off the coast to deposit their precipitation out in the Atlantic. Many of you, however, in the Midwest and West have experienced extreme cold and above normal snowfalls. Obviously, the climate in the U.S. is changing. In my lifetime I recall heavy ice storms and snowfalls here, including our Blizzard of '78, when all transportation in and out of Boston was prohibited for several days by order of the governor. You may recall student days at MIT during that period.

February continues to bring with it our annual Orientation & Selection Period for the VI-A Program; this year is no exception! On February 5, Director **Kevin O'Toole**, SM '57, NE '57 (XIII), started the process by presenting his orientation talk. A week later students currently on the Program ran a student open house providing one-to-one contact between potential students and active VI-A's to informally discuss experiences at the various employing companies.

On March 2, our company representatives were on campus for our annual business meeting/dinner and company open house. Two days of formal interviews followed and then the final selection/matching process for a new VI-A Class began. I'll report on these results in a future column. The VI-A staff has received numerous preliminary inquiries indicating continued strong student interest in the Program.

Receipt of Christmas cards was down this year, accounted for, perhaps, by the widening gap since graduation, during my tenure, and the drifting off of contacts with time. Some of those VI-Aers I heard from included: **Steven L. Bates**, '74, SM '76, EE '76, **Geoffrey J. Bunza**, '74, SM '77, EE '78, PhD '81, **John F. Cooper**, '74, SM '76, **Edward C. Giaimo**, '74, SM '75, **Cecil H. Green**, '23, SM '24, and **David L. Lyon**, '69, SM '70, PhD '72.

In the Honors & Awards category, which is always a pleasure to report on, Professor Emeritus **William F. Schreiber** has been elected a Fellow of the Society of Motion Picture and Television Engineers for his contributions to image coding systems, color processing, interactive color editing systems, and color correction for graphic arts. "The color system developed at MIT is now the standard in desktop publishing," states the Society's announcement. Schreiber headed up MIT's Advanced Television Research Project from 1981-89, where the MIT-CC HDTV system was developed.

A current VI-A student, **Casimir M. Wierzynski**, is a recipient of a prestigious British Marshall Scholarship which grants up to three years of all-expenses-paid study at any British university. 'Cas' was one of two MIT recipients who were selected from among 800 applicants nationwide. His VI-A company affiliation is AT&T Bell Labs. And **Daishi Harada**, currently co-opting at Digital Equipment Corp., has been selected by MIT's School of Humanities and Social Science to be a 1992 Burchard Scholar. The Bur-

chard Scholars Program pairs juniors and sophomores showing promise in humanities and social science with faculty of that school, in a series of dinner-seminars for discussion of various topics of current interest.

Personal contacts with VI-A alumni since last writing (no ae's this time), include: **Thomas Dur-gavich**, '75, SM '76, who called to inquire about the VI-A 75th plans. He is still working in the Tech Square area. . . . **Niels E. LaWhite**, '87, who stopped in to say "hello," talk over some future plans, and tell me he is still living in Vermont and involved in energy systems. . . . **Steven D. Levy**, '86, SM '86, whom I met at lunch one Saturday in Wellesley, Mass. He tells me his business enterprise is developing nicely and is now located in an office in Post Office Square in Boston. . . .

Robert W. Mayer, '41, SM '42, with whom I had a delightful conversation about the VI-A 75th along with some reminiscences of his era of participation in VI-A with the General Electric Co., the first company to participate in what was then called "Course VI-A." . . . **Lewis H. Rosenthal**, '73, SM '74, who called about the VI-A 75th, who's with Motorola/Schaumburg and has some VI-A students in his group. . . . And finally, a visit from **Thomas R. Shiple**, '86, SM '87, who was here to collect his wife, **Suzanne D. Lau**, SM '87, who just finished her PhD work, to take her back to Fremont, Calif., where they'll be living while Tom continues his PhD work at the University of California at Berkeley.—**John Tucker**, Director (emeritus), VI-A Program & Lecturer, MIT, Rm. 38-473, Cambridge, MA 02139-4307.

VII BIOLOGY

Carl O. Pabo, MIT professor of biophysics and a Howard Hughes Medical Institute Investigator, has won the Pfizer Award in Enzyme Chemistry for 1992. The award was presented at the dinner of the Division of the Biological Chemistry during the national meeting of the American Chemical Society in April. . . . **Gene M. Brown** has been named the Whitehead Professor in the Department of Biology. The Whitehead Professorship was established by MIT in 1982 in recognition of the affiliation between MIT and the Whitehead Institute for Biomedical Research. It is awarded to a distinguished professor active in the biomedical or life sciences. Brown's selection for a five-year term reflects his "outstanding achievements in the biological sciences, his continued commitment to excellence in education and research, and his admirable leadership and service to the Institute." Provost Mark S. Wrighton said in announcing the appointment. Brown, dean of science from 1985 to June 1991 and head of the Department of Biology from 1977 to 1985, is a noted enzymologist. His research is focused on the isolation, biosynthesis, and function of vitamins, coenzymes, and related substances.

VIII PHYSICS

W. Murray Bullis, PhD '56, sends word from Sunnyside, Calif.: "In 1991, I resigned my position as VP for R&D at Siltec Silicon, a manufacturer of silicon wafers for the microelectronics industry, and established Materials & Metrology, an international consulting firm specializing in silicon crystal and wafer technology." . . . **Peter Fowler**, SM '60, writes: "I continue to enjoy retirement. I cruised the Leeward Islands and then sailed a Morgan 43 from Antigua to Lynn, Mass., via Bermuda. Also, I have recently gotten a U.S. Merchant Marine Officer license for 50-ton auxiliary sail vessels." . . . **Herbert Goldstein**, PhD '43, has retired as emeritus professor of nuclear science and engineering from Columbia University, effec-

tive January 1, 1992. . . . After three years as chair of the New York University Physics Department, **Henry Stroke**, SM '52, PhD '55, is spending a sabbatical year at CERN in Geneva, Switzerland. . . . From the Plasma Physics Lab at Princeton University, **V. Arunasalam**, PhD '64, writes: "I have been recently appointed to an honorary position as an associate editor of *Physics Essays*, an international journal dedicated to fundamental questions in physics. This journal is of an interdisciplinary nature in physics and is particularly interested in debating fundamental questions of physics. I happily invite all prominent physicists to contribute."

David S. Stone, PhD '79, has been named director of Electronic Warfare Engineering at Sippican, Inc. Previously, he was a staff physicist for the Marion, Mass.-based firm. . . . **Edward W. Webster**, '51, has been awarded the 1991 Gold Medal of the American College of Radiology. Webster is professor of radiology at Harvard Medical School and chief of the radiological sciences division in the department of radiology at Massachusetts General Hospital. Among his many accomplishments, Webster was involved in the development of low-dose mammography screen film systems. . . . **Nicholas M. Tomljanovich**, PhD '66, has been promoted to department head of Advanced Radar Technology with responsibility for sensor support to over-the-horizon (OTH) radar and advanced surveillance sensor projects, at Mitre in Bedford, Mass. Tomljanovich's most recent activities have concentrated on advanced airborne radar evaluation, including ASTT and ASTAR. He has supported OTH radar studies and participated in the assessments of multistatic passive systems and ultrawide band radar for ADI application.

Course VIII Professor **Stanley Kowalski**, PhD '63, has been named director of the Bates Linear Accelerator Center at MIT. Kowalski, who has been the center's associate director since 1985, has been a leader in the development of new technical capabilities for nuclear physics research with electron beams. Kowalski's research in the 1970s used high resolution spectroscopy to map out for the first time the spatial distribution of charge and magnetization in rare-earth deformed nuclei. This work had a major impact in quantitatively verifying the predictions of nuclear mean-field calculations. At present he is spearheading the efforts to complete construction of the Bates South Hall Ring, which will provide unique new capabilities for the national research community. Kowalski succeeds **Ernest J. Moniz**, who was appointed head of the Department of Physics earlier this school year. . . . **Henry W. Kendall**, PhD '55, who shared the 1991 Nobel Prize in Physics, has been named to the Julius A. Stratton Professorship in Electrical Engineering and Physics. Kendall, internationally known for his research involving the internal structures of elementary particles and for his work as a founding member of the Union of Concerned Scientists, is the second holder of the chair established in 1979 by William R. Hewlett, SM '36 (VI), a founder of Hewlett-Packard. The chair, which honors Julius Stratton, '23, SM '26 (VI), MIT's 11th president, is held alternately by faculty from Course VIII and Course VI, reflecting his continuing interest in those disciplines. The first holder of the chair was the late James Melcher, PhD '62, who died in January 1991. Kendall has been a member of the faculty since 1961.

John W. Negele has been named the William A. Coolidge Professor in Course VIII. Negele, director of the Center for Theoretical Physics, is widely known for his contributions to quantum theory of many-body systems. He carried out the first microscopic calculation of nuclear structure, leading to an understanding of the precise charge distributions measured with electron scattering in terms of the basic nuclear force. Negele was appointed to the five-year professorship, which was established by the Executive Committee of the MIT Corporation to honor Mr. Coolidge, a life member of the Corporation, for his thoughtful

advice and generosity over several decades. . . . Course VIII Professor **Bruno Coppi**, an internationally respected fusion scientist and one of the originators of the Alcator concept, received the Fusion Power Associates' annual Leadership Award from the DOE. The citation accompanying the award said it was presented in recognition of Coppi's outstanding leadership qualities: "Over many years you have provided technical insights that have influenced the design of fusion reactors and led the fusion community towards more cost-effective systems and experiments." The group also said that Coppi has "consistently pointed out directions which could lead to practical fusion applications along affordable development paths and presented a constant challenge to the 'business as usual' attitudes that frequently characterize scientific circles."

Merrill L. Andrews, PhD '68, of Beavercreek, Ohio, died on August 23, 1991. He was chair of the Wright State University Physics Department and was employed as a contractor at Wright-Patterson AFB in the Plasma Physics Division. Andrews joined the university in 1970 and was named director of the WSU Engineering-Physics Degree Program in 1974. Prior to joining the WSU faculty, he was an assistant professor of physics at Cornell University and had been a teaching assistant and research assistant at MIT. He was a member of the American Association of Physics Teachers, the American Physical Society, and served as committee chair of a Boy Scout Troop.

IX BRAIN AND COGNITIVE SCIENCES

Emilio Bizzi, the Eugene McDermott Professor in the Brain Sciences and Human Behavior and head of Course IX, has been selected as the 1992 recipient of the Hermann von Helmholtz Award. It is given by the Cognitive Neuroscience Institute of Norwich, Vt., for "excellence in neuroscience."

X CHEMICAL ENGINEERING

Will K. Fraizer, SM '80, writes: "I have just completed a busy year as environment and safety manager for Chevron Niugini in Port Moresby, Papua, New Guinea. Construction is continuing on the Chevron-operated Kutubu Project with first oil export scheduled for mid-1992. Our airfield and mini-refinery are operating already, receiving cargoes by Hercules Aircraft, and producing jet and diesel fuel. All this is occurring in a remote, rugged area of PNG's Southern Highlands. Last November, I presented a paper on how we're implementing our environment and safety policy at the SPE conference in the Hague. During my time off I've had a chance to explore in Australia including Cairns, the Great Barrier Reef, Ayers Rock, the Andamooka Opal Fields, and Brisbane. PNG hosted the South Pacific Games in September so I was able to attend a few of the final track events and the closing ceremonies." . . . From Houston, **Howard Grekel**, SM '47, reports: "I am actively consulting in the petroleum industry in gas and oil production, natural gas processing, gas pipeline operations, NGL terminal operations with management and operating personnel. In last 15 years 250 operating teams using our proprietary system and techniques have increased annual profits by \$141,000,000."

Edward C. Hume III, PhD '83, sends word: "I have been elected to serve as the president of the Harvard Club of Austin, Tex., for 1992. Thankfully my MIT degree did not disqualify me. Also, I was promoted to senior engineer at IBM where I am involved in systems integration work for plant floor customers." . . . **Donald W. Peaceman**, ScD '51, was awarded the Anthony F. Lucas Gold Medal by the Society of Petroleum Engineers. . . .

David Brown, SM '40, writes: "I am happily retired in Florida and Highlands, N.C." . . . **Graham A. Woerner**, SM '76, reports: "I received a patent for Isocore (R) Coaxial Cable, a manufacture process I developed." . . . From Paulsboro, N.J., **Ronald A. Sills**, SM '66, PhD '70, sends word: "I am manager for research planning at Mobil R&D Corp. I am coauthor of a recent National Research Council book, *Fuels to Drive Our Future*. I presented a talk "Measuring the Value of R&D Activities" at the 1991 Industrial Research Institute annual meeting." . . . **David Rubin**, SM '75, reports: "I am currently employed by URS Consultants, in Paramus, N.J., as a manager of environmental and hazardous waste projects."

David L. Swift, SM '59, writes: "I am professor of environmental health studies at Johns Hopkins School of Hygiene & Public Health, and I carry out research on the deposition, fate, and effects of airborne particles. My current research activities include work on radon progeny aerosols. I am a member of the National Council of Radiation Protection Task Group on Modeling of Radioactive Aerosol Exposure. I gave a research presentation at the 7th International Symposium on Inhaled Particles held last year, and I lectured on particle inhalation and effects at Mexico Institute of Public Health last November." . . . **Christian W. Knudsen**, SM '65, ScD '69, reports: "I am president of Carbotech, Inc., a Houston process development lab. I am involved in developing a process to make oxygen on the moon—funded by the Shimizu Corp. of Tokyo and NASA. We have a growing business with the U.S. chemical industry for bench scale and pilot plant projects." . . .

Arthur D. Schwoppe, SM '72, has been named VP at Arthur D. Little, Inc. Previously, he was a unit leader for the Cambridge-based company. . . . **Clark K. Colton**, PhD '69, has edited *Perspectives in Chemical Engineering: Research and Education* (Academic Press, 1991), Volume 16 of *Advances in Chemical Engineering*. According to a press release, "This special edition, commemorating chemical engineering's centennial as an academic discipline, provides an in-depth analysis of this field's past, present, and future by foremost authorities of virtually all areas of chemical engineering."

The 1991-92 Merck Industrial Fellowship at MIT has been awarded to **Rahul Singhvi**, SM '89, a Course X graduate student, for his research into the "effects of surface substratum morphology on animal cell growth and product characteristics." The fellowship was established last year by Merck's Pharmaceutical Manufacturing Division in the School of Engineering's Biotechnology Process Engineering Center "to facilitate biotechnology research and, in particular, advances in both pharmaceutical and biological manufacturing." The fellowship provides financial support for PhD candidates of \$30,000 a year, as well as for summer internships and Merck executive mentors who introduce students to the industrial environment. . . . Two newsworthy notes about **Robert Langer**, ScD '74, the Kenneth J. Germeshausen Professor of Chemical and Biochemical Engineering. He is the winner of the 1991 C.M.A. Stine Award for Materials Engineering and Sciences given by the American Institute of Chemical Engineers. The awards committee cited Langer, a leader in the fields of polymers and bioengineering, for "pioneering contributions to the synthesis of new polymeric materials, their innovative structural modification, and their skillful application in a wide range of pharmaceutical and biomedical uses." Langer has also been elected to the board of directors at Omni Quest Corp., a magnetic specialty chemicals firm.

Karen K. Gleason, '82 (V), SM '82, has been appointed an Esther and Harold Edgerton Assistant Professor for a two-year term at MIT. Gleason probes the structure-property-processing relationships of thin films and interfaces. She is also interested in nuclear magnetic resonance techniques

for characterizing thin films. She joined the MIT Course X faculty in 1987.

Robert L. Purvin, ScD '41, of Mamoroneck, N.Y., died on June 19, 1991. He was a chemical engineer and energy consultant. As a consultant, he came up with creative solutions for seemingly unsolvable engineering problems. As a leader in establishing imports of liquefied natural gas from North Africa, for example, he developed, in concert with others, the design mechanism for transporting natural gas by ship, using the vessel as a giant thermos bottle to move gas in quantity. In 1982 he founded Robert L. Purvin Associates, chemical engineering consultants. Before that he was president and CEO of Barber Oil in Manhattan and chair of Purvin and Lee, Inc., from 1975-1982. From 1957-62, he was executive VP and director of Foster Grant Co., Inc., sun glass manufacturers in Leominster, Mass., where he increased the company's manufacture of plastics. In 1946 he founded Purvin & Gertz, Inc. in Dallas, a chemical engineering firm with which he was associated until 1957. . . . **Halsted R. Warrick**, SM '32, of Hendersonville, N.C., died on August 30, 1991. He was employed by Texaco as a chemical engineer stationed in Port Arthur, Tex., New York City, Rotterdam, Holland, and London, England. . . . **Domenic B. Vassallo**, SM '56, of Bethesda, Md., died on November 26, 1991. He was a nuclear engineer at Pratt & Whitney for 10 years and in 1966 he joined the Atomic Energy Commission in Washington. He later became assistant director of the Nuclear Regulatory Commission and retired in 1988. For the past two years he was a consultant for Sciencetech, Inc., in Washington, D.C.

XI URBAN STUDIES AND PLANNING

Anniken Kloster, MCP '87, writes: "I have been stationed as a junior professional officer with UNICEF in Rabat, Morocco, since March 1991. I am working mostly on the monitoring and evaluation of the UNICEF programme of cooperation with Morocco." . . . **Robin Moore**, MCP '66, reports: "I am currently a professor of landscape architecture in the School of Design at North Carolina State University in Raleigh and director of training and dissemination at the Center for Accessible Housing, also at NCSU. I was the director of a recently completed research project proposing recommendations for children's accessibility standards to the federal government. I was recently elected president of the International Association for the Child's Right to Play—a consulting NGO to UNICEF. As a principal in Moore, Iazofano, Goltsman, I continue to work as a consulting planner and designer in community planning and the design of children's environments and educational settings—particularly in South America." . . . **Craig S. Barnes**, MCP '82, has been



C.S. Barnes

named a partner in the San Francisco-based Sedgwick, Detert, Moran & Arnold, a 170-attorney international civil litigation and trial law firm. Barnes concentrates his practice in the area of products liability law in the firm's L.A. office." . . . **William D. Tuttle III**, SM '88 (IV), MCP '88, sends word: "For a year now, I've been working as an urban designer for Stull and Lee on the Central Artery/Tunnel Project in Boston. In real life, my wife Karin and I try to keep up with Thomas and John Peter, our twin 3 1/2-year-olds (born the day after graduation!)."

Word from **Robert E. Herzog**, MCP '87, and

Kathryn Ludwig Madden, SM '88 (IV), MCP '88, in Watertown, Mass.: "Kathryn Ludwig has changed her name to Kathryn Madden. She and Roger Herzog were married in September 1990 and gave birth to a daughter, Madelyn Rose, in September 1991. . . . **Nicole R. Faghin**, MCP '86, writes: "After practicing law for three years I recently joined an engineering firm, based in Seattle and opening an office in Anchorage, as a regulatory/permitting project manager (technically, a planner). In December our daughter Rachel was born—our first." . . . **Felix Arroyo**, '86, director of personnel for the City of Boston, has been appointed a member of the Boston School Board. . . . **Thomas A. Stokes**, MCP '84, has been named assistant dean and director of multicultural affairs at Holy Cross College. Previously he was associate director of admissions and assistant to the VP for academic affairs at the Worcester, Mass., college.

Merrie G. Klapp, whose intellectual interests spanned the fields of architecture, mechanical engineering, semiotics, communications, environmental policy, and political science, died December 9, 1991, of brain cancer. Klapp, 41, was a research affiliate and former Course XI associate professor.



M.G. Klapp

After receiving an MS degree in mechanical engineering at Stanford in 1973, she traveled to Italy, where she met Professor Umberto Eco, the renowned semiotician and author with whom she collaborated on a semiotic approach to intercultural communication in Europe. Their work produced several articles including one on a new notion of "territoriality" in the social meaning attributed to urban space. She received her PhD at the University of California at Berkeley in 1980 in the Department of City and Regional Planning. In 1981–82 Klapp was a research fellow at both the Woods Hole Oceanographic Institute and MIT's Center for International Studies. She was appointed assistant professor in Course XI in 1982 and became associate professor in 1989. Initially her research at MIT focused on the role of government in natural resources policy, resulting in several articles and the book *The Sovereign Entrepreneur*. Later, at the direction of her department, she turned her attention to the political aspects of environmental policy and, even while struggling with cancer, produced numerous articles and the book, *Bargaining with Uncertainty*, published in January 1992 by Auburn House Press of the Greenwood Publishing Group. Last year as a research scholar at the Institute for International Studies at Berkeley, Klapp began research for a book on the Italian textile industry, to introduce regional, as opposed to national, governments as a critical element in international industrial theory. Despite her illness she made three trips to Italy and conducted more than 60 interviews for the book. She left an outline of her proposal but the book itself was never written. Klapp is survived by her husband, Sy D. Friedman, PhD '76 (XVIII), professor of mathematics at MIT.

The Association of Alumni and Alumnae at the Massachusetts Institute of Technology has been notified that **George W. Walsh III**, SM '57, of Durham, N.C., died on October 10, 1991. There was no further information provided.

XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

Grant Buma, SM '70, writes: "I am currently department manager for all environmental work at Versar A&E in Orem, Utah. I am also chairman of the HWAC Committee of the Consulting Engineers Council of Utah and president-elect of the Utah chapter of AIPG. We are involved in a wide variety of environmental restoration projects for both government and the private sector—an area where there is a great need for high-tech expertise. One of our top priorities is the development of a viable air quality program for our state and its industries." . . . **Steve Foster**, SM '73, reports: "I was recently transferred from Syria to Thailand. I'm doing development geophysics using a land-mark interactive 3D seismic workstation." . . . From Argentina, **Verónica C.G. de Posadas**, SM '66, reports: "I'm an assistant professor in geochemistry, "ad honorem," (that means I'm not on the payroll!), and also a lecturer in the same course (I do receive pay on that, please don't ask how much—it's a laughing matter), in the Natural Sciences School at La Plata University. I do some research support determining trace elements in rocks by X-ray fluorescence. I have three girls. The eldest became an MD last December, the second is working toward a master's in zoology, and the 'baby' is a high school freshman. I've been married to the same fellow (Dr. Posadas, MD) for 27 years!" . . . **James H. Knapp**, PhD '89, sends word: "After three years with Shell Oil Co. in both Houston, and New Orleans, I am now working as a research associate with the Institute for the Study of the Continents at Cornell University in Ithaca, N.Y."

From **Julius Honig**, SM '53, in Los Altos, Calif.: "I retired from IBM in 1986. I joined Golden Gate University as chairman of the Information Systems Department and after four years as chairman, I became director of academic computing at the university, a position I still hold." . . . **Charles W. Welby**, PhD '52, lives in Raleigh, N.C., and serves as chair of the Engineering Geology Division in the Geological Society of America. . . . **Pam Melroy**, SM '84, writes from Edwards AFB, Calif.: "I am attending USAF Test Pilot School to become a test pilot. I will graduate in June 1992." . . . **Norman E. Gaut**, SM '64, PhD '67, president and CEO at Picturitel Corp., in Peabody, Mass., has been named to the board of directors at Bytex Corp. in Southborough, Mass. . . . On December 30, 1942, one of the war-time special classes in meteorology graduated from MIT. Of the 120 graduates, 89 are still alive and a 50th reunion is being planned for these graduates to be held in Boulder, Colo., September 20–23, 1992. The reunion will include both students and faculty. Anyone wishing further information can contact Roger H. Olson, 1740 Sunset Blvd., Boulder, CO, 80304, 303-444-0801.

Richard P. Binzel, Course XII associate professor, has been awarded the 1991 Harold C. Urey Prize by the Division for Planetary Sciences of the American Astronomical Society. The prize, named in honor of the late Nobel laureate in chemistry who was a pioneer in the study of geochemical processes in the solar system, is given annually to recognize and encourage outstanding achievement in planetary research by a young scientist. Binzel was recognized for his observational and theoretical research on asteroids and the planet Pluto. On a broader scope, he served as the principal organizer of an international conference on asteroids and was principal editor of the 1,250-page Arizona Space Science Series book, *Asteroids II*, which serves as the reference book for the field. Binzel was also responsible for making the first confirmed detection of the once-per-century series of transits and occultations between Pluto and its satellite, Charon. His photometric observations of these events from 1985 through 1990 are being used to map the unresolved surfaces of Pluto and

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Charon. From these maps Binzel is also studying the long-term evolution of seasons on Pluto. He also has been selected as a 1991–92 recipient of a secondary Fullam/Dudley Award to support his research project, "Small Main-Belt Asteroid Spectroscopic Survey: A Search for the Missing Pieces." . . . **Leigh H. Royden**, PhD '82, associate professor of geology and geophysics in Course XII, is one of 25 female scientists and engineers from U.S. industry, government, and academic institutions awarded grants from the National Science Foundation for visiting professorships. Royden will visit CalTech, pursuing her research project, "Late Cenozoic Extensional Deformation of Bulgaria and the Role of Lower Crustal Flow in Continental Deformation." She will also serve as a role model and engage in special mentoring activities.

XIII OCEAN ENGINEERING

John M. Chiffer, SM '83, writes: "I left U.S. Navy submarine duty aboard the USS *Bremerton*, in Pearl Harbor, Hawaii, in 1988. I then joined the Marine Systems Group at Draper Lab in Cambridge, designing undersea vehicles and marine systems. I am engaged to be married to Joan Morrison (also of Draper Lab) this spring." . . . From Northport, N.Y., Lieutenant **Kevin J. Fox**, SM '83, reports: "I completed a master's in mechanical engineering at Poly Technic University this year. I am working for Long Island Lighting Co. as manager of gas operations. My third son was born last October." . . . Commander **Norman K. Berge**, SM '60, NE '60, USN (ret.), sends word: "I fully retired from Bath Lumber Co. I am the treasurer of the following organizations: Mid-Coast Maine United Way, Casco Bay Maine Council-Navy League of U.S., and the Shiloh Commissioning

Martin Abkowitz

1918-1992

Martin A. Abkowitz, '40, professor of ocean engineering emeritus and an international authority on ocean vehicle hydrodynamics, died of cancer on January 26.

Abkowitz, who was born in Revere, Mass., in 1918, received an SB in naval architecture and marine engineering from MIT and an MA and PhD from Harvard. From 1940-42, he was a naval architect with the U.S.



Navy's David Taylor Model Basin in Washington, D.C. During the remainder of World War II he served with the U.S. Army's Transportation Corps and held the rank of captain. After the

war, he returned to the David Taylor Model Basin as a physicist. He was appointed to the MIT faculty in 1949 in what was then called the Department of Naval Architecture and Marine Engineering. He was appointed full professor in 1959.

Abkowitz's teaching and research emphasized ship motions in waves and the stability of ships and submarines. He was responsible for the design, construction, and operation of the MIT Ship Model Towing Tank, and served as its director for many years. He formally retired in 1988, but he continued to be active in professional activities until he became ill last year. He traveled and lectured extensively throughout Europe, Israel, and Asia.

Abkowitz was awarded Fulbright Fellowships to the Technical University of Denmark (1962-3) and the University of Nantes, France, (1971-2), and a von Humboldt Fellowship to the University of Duisburg, Germany (1990-91). □

Committee."... **Henry I. Gonzalez**, SM '83, writes: "I was recently selected as the technical director for the Navy's new Unmanned Undersea Vehicles (UUV) in the Program Management Office (PMO) located in the Washington, D.C., area."... From Westerly, R.I., **Henry J. Nardone**, NE '52, reports: "I am the division program director for the Trident Submarine Program, 688 Class submarines, and post delivery submarines. I have been with the Electric Boat Division of General

Dynamics Corp. since 1955."

Koichi Masubuchi, the Kawasaki Professor and professor of materials science and ocean engineering at MIT, is one of 13 longtime members of the American Welding Society to be named Fellows of the society—the first group so honored. The designation recognizes AWS members for distinguished contributions in the field of welding technology. Masubuchi, a life member of the society, is an authority on welding fabrication of marine and aerospace structures, and a leader in the introduction of computer technologies to the analysis of welded structures and modeling of welding fabrication.... **Leopold B. Felson**, a Course XIII visiting professor for the past two years, has been awarded the 1991 Heinrich Hertz Medal of the IEEE. The medal, which recognizes outstanding achievement in the field of electromagnetic radiation, is being given to Felson for "highly original and significant developments in the theories of propagation, diffraction, and dispersion of electromagnetic waves." Felson is a university professor and former dean of engineering at Polytechnic University in Farmingdale, N.Y. His research at MIT is focused on structural acoustics—the propagation of sound through and from complex structures.

Captain **Stanley M. Alexander**, SM '35, of West-on, Mass., died on December 20, 1991. He was a supervisor of shipbuilding at Bath Iron Works in Maine, where he worked for 30 years. He then served as assistant to the president of Mitre Corp. for 10 years. Alexander was a member of Naval Architects and the New York Yacht Club.

XIV ECONOMICS

Jerry A. Hausman, Course XIV professor and one of the world's leading econometricians, has been named to the John and Jennie S. MacDonald Chair. Hausman received the Frisch Medal of the Economics Society in 1980 and the John Bates Clark Award of the American Econometric Association, given every two years to the single most prominent economist under the age of 40, in 1985. He is director of MIT's Telecommunications Business and Economics Program.... **Lawrence Katz**, PhD '86, has recently been promoted to professor of economics at Harvard University. As a specialist in the areas of labor and applied economics, he has concentrated mostly on the wage structure and unemployment, which he says play a critical role in such problems as homelessness, crime, and poverty. He is coeditor of the *Quarterly Journal of Economics*.

Peter A. Diamond, PhD '63, the MacDonald Professor of Economics, has been selected as the first holder of a new professorship named for **Paul A. Samuelson**, Institute Professor Emeritus and one of the founding members of the MIT Department of Economics. The Paul A. Samuelson Professorship, established last year, honors one of the foremost economists of the 20th century. In recognition of his many contributions to the field, Samuelson was awarded the Nobel Prize in 1970. He has worked on extending the Keynesian model of the economy into a dynamic framework, and has been a pioneer in the analysis of uncertainty in economic behavior. This last area led Diamond in macroeconomics and his work has been at the forefront of the current recasting of macroeconomic theory. In addition to his theoretical contributions to economics, Diamond has been involved in policy matters, serving on the U.S. Senate Finance Committee's Panel on Social Security Financing in the mid-1970s and currently on the Panel of Technical Experts consulting to the President's Advisory Council on Social Security.... **George W. Shuster**, SM '69, has been named president and CEO at Cranston Print Works Co. Previously he was group VP for manufacturing at the Cranston, R.I.-based firm.

XV MANAGEMENT

Carol Holmes Redfield, SM '87, sends word: "Chris Redfield, SM '87, and I are still in California. Chris is a manager of distribution planning for Dole. I am a senior associate with DFL, a consulting firm specializing in the application of management science to industry."... **Susan A. Egnoto**, SM '84, writes: "We had a wonderful baby girl on October 12, 1991, Grace Isidora Wal-lack. After taking off 3 1/2 months, I went back to Silicon Graphics in February where I manage the graphic arts and publishing market."... **Anne Quinn**, SM '77, reports: "In June 1991 I relocated to Brussels (from London) to form part of British Petroleum's new European organization. I'm enjoying it immensely. Since joining the oil industry in the early 1980s (after five years as a management consultant), I've worked at a wide range of positions (acquisitions, strategy and business development, and marketing operations), plus I've seen a bit of the world—this is my fifth city. Happy to see fellow Sloan grads in Brussels."... **John C. McDugald**, SM '79, retired from the U.S. Army in 1990 and is now teaching middle school science.... From San Francisco, **Walter Conway**, SM '72, writes: "I married Meredith Tennent (Mt. Hoyoake, '71) last October. I have a new position/promotion as director of worldwide marketing for VisaNet New Business Development, part of Visa International's Global Delivery System."

Word from **Raymond Clarke**, SM '85, and **Carol Imm Clarke**, SM '85, in Arlington, Va.: "Ray has enjoyed being reunited with classmates **Carla J. Heaton**, SM '85, and **Laurence P. Dodge II**, SM '85, now that SPA has been merged with Temple Barker & Sloane into the newly minted 'Mercer Management Consulting.' Carol returned to 5 days a week (from 4) at Marriott where she is a senior director of strategy & business development. We are looking forward to a brother or sister for Alison Claire in May."... **Burt Nanus**, SM '59, continues as a professor of management at the University of Southern California in Los Angeles.... **Marvin Campen**, SM '48, reports: "My daughter, Daisy Elizabeth Campen, was born on October 28, 1991. She is my second daughter in my second family, started in 1988, 40 years after I graduated from MIT."... **Steve Shapiro**, SM '75, director of international marketing and planning at GTE Spacenet Corp., in McLean, Va., writes: "After the merger between GTE and Contel, our respective satellite communications subsidiaries were combined. I am now managing the financial and marketing functions for the newly created International Networks division. Would love to hear from former classmates."... **Paul R. Freshwater**, SM '68, reports: "I am regional manager of public affairs for the Procter & Gamble Co., VP of the Charter Committee of Greater Cincinnati, chairman of a Sea Explorer Scout unit, and treasurer of a small film production company."... From Rockville, Md., **Richard A. Ferraro**, SM '82, writes: "After spending less than 30 working days in town in all of 1991, I left my position as principal of A.T. Kearney and formed Ferraro/Cecil, Inc., with another consulting colleague. Our firm will focus on the Washington, D.C., market—primarily trade and professional associations, with a special emphasis on improving the effectiveness of governing boards. With two children, it will be nice to work the travel down to something under 50%."

Michael L. Bunday, SM '88, reports: "As of November 18, 1991, I have been working as an AVP at Chase Manhattan Bank's Chase Home Mortgage division. Responsibilities involve the creation of structuring of CMO's which are then sold to underwriters as AA and AAA securities. Prior to this, I was working as a marketing analyst in Chemical Bank's Consumer Deposit Marketing division."... **Suellen Fausel**, SM '86, sends word:

"I am enjoying being a full-time mom with new daughter, Chapin Elizabeth, born August 20, 1991. Also anticipating learning where we will spend husband's vicarage year in his study for the Lutheran ministry." . . . From Paris, France, **Francis P. Bernard**, SM '75, writes: "I am married with two daughters, Aurelia (11), and Audrey (6). I am general manager of Telic Alcatel in the up growing telecommunications environment." . . . **Hans J. Dendl**, SM '59, sends word from Germany: "I am president of Dendl Ceramics AG, a ceramic operation for garden and house. We have a new operation in Italy and Yugoslavia. I am also a consultant in social security and health administration for the self-administered German system. I'm living in historic Regensburg, home for a new university and BMW production." . . . **Thomas G. Ioeberger**, SM '75, reports: "My part of Westinghouse has been sold to a capitalist, the bank, and management. We are now TCom, L.P. I am now VP for programs management. Leaving Westinghouse is a big change, almost all for the better."

From **Bradford H. Elliott**, SM '87, in New Hope, Pa.: "I'm still working for Toll Brothers, Inc., as a project manager. We're about to start a new 850-unit golf course community. Now there is now excuse, I have to take up the game. Robin and I moved into our new home we built a year and a half ago. Then came Peter. He is under a year and we love him." . . . **Lawrence S. Daniels**, SM '66,



L.S. Daniels

has been named VP for marketing and business development at Biogen, Inc., in Cambridge. He will be responsible for Biogen's business development, strategic planning, and general commercial activities worldwide. Formerly, Daniels was with Allied Signal, Inc., in Morristown, N.J., where he had been VP for corporate strategy development. . . . **Thomas L. Mays**, SM '77,

writes: "I am currently executive VP/COO of the Pomerleau Agency, Vermont's largest insurance agency. I was recently promoted to lieutenant colonel in the U.S. Army Reserves. I'm also the proud father of three beautiful girls, 8, 6, and 6 months." . . . **Robert R. Radcliffe**, SM '82, reports: "I am working as director of North American Sales and Marketing for Integrated Solutions, Inc., a graphical user interface tools software house in King of Prussia, Pa." . . . **Bruce A. H. McFadden**, SM '75, sends word: "The major news for 1991 is my marriage on August 10 to Cheryl Willian Balleri of St. Paul, Minn., who is a very nice and absolutely delightful lady! Serving as president of the MIT Club of Minnesota continues to be fun and I'm meeting many Sloan and other MIT Alumni/ae. I would welcome seeing or hearing from any Sloan classmates." . . . From Toronto, Ontario, **Douglas B. Lowry**, PhD '69, reports: "I am writing and consulting through the Institute for Ethics and Leadership, which is based at a Franciscan University in Steubenville, Ohio." . . . **Thomas R. Caruso**, SM '84, writes: "I was recently given the position of project manager for the new asset management software product line called Ultrast. Hope to buy a house in the Boston area in the near future."

Diana J. Mackie, SM '79, reports: "I am in the middle of three professional and geographical moves over nine months. First I left McKinsey after 12 years and took a special assignment in the Office of the Commissioner for the FDA. For four months near Washington, D.C., I worked with the management of the Center for Drug Research & Evaluation on bringing in new management practices to the regulatory review process. While in

D.C., I was in touch again with Maria Burka, '69, SM '70 (X), program director at the NSF, with whom I went to Course II, VI, and X classes in the late '60s. Second, just before Christmas, I accepted a position as VP for corporate development at Smith Kline Beecham, the London-based diversified health care company. In mid-January I started working with the Animal Health unit. Finally, in the summer, I will be relocating to London to the corporate offices. I expect to be there two to four years and hope to renew Sloan acquaintances and find an MIT Alumni Club."

William E. Cook, SM '74, has been named president, CEO, and member of the board of directors of Data Design Laboratories, Inc., in Anaheim, Calif. Previously, he was president, CEO, and founder of Signal Technology Corp. in Weymouth, Mass. . . . **Christopher B. Alt**, PhD '82, has been named an assistant professor in the Finance Department at Babson College in Wellesley, Mass. Previously he was CFO and treasurer at Cortex Corp. in Waltham, Mass. . . . **Krishna Palepu**, PhD '83, an expert in financial analysis and corporate finance, has been promoted to full professor at Harvard Business School. Palepu, a member of the faculty since 1983, focuses on firms' investment decisions and their interactions with corporate strategy. . . . **Karl F. Koster**, SM '80, corporate relations manager with the Industrial Liaison Program at MIT since 1987, has been named director of corporate development at MIT. In his new position, Koster will be responsible for the preparation, development, coordination, and implementation of plans for soliciting major gifts from corporations, particularly for endowment. Before joining MIT in 1987 he was a managing associate with Theodore Barry & Associates, an international management consulting firm. . . . The International Financial Services Research Center at Sloan has appointed two associate directors—**Paul Asquith**, for the area of finance and economics, and **Amar Gupta**, for the area of information technology. Asquith, Course XV associate professor, teaches finance topics in the master's, Sloan Fellows, and executive programs. Gupta, the first and only senior research scientist at the Sloan School and a founding member of the Center, has developed automated techniques for reading amounts on bank checks.

Daniel M. Holland, of Lexington, Mass., died on December 15, 1991. He was professor emeritus of finance at the Sloan School of Management and a widely known expert on taxation and public finance. Holland was an MIT faculty member from 1958 until his retirement in 1986, when he became an emeritus professor and senior lecturer. He also served as an assistant to the provost from 1986 to 1990. He was a consultant over the years to government agencies, including the U.S. Treasury, foreign governments, and private companies. He was editor of the *National Tax Journal* for more than 20 years, served as president of the National Tax Association in 1988-89, and was the author of several books on taxation and numerous articles both in professional journals and other publications. His books included *Dividends Under the Income Tax and Private Pension Funds: Projected Growth*, for which he received the Elizur Wright Award of the American Risk and Insurance Association. Holland served three years in the Navy during WW II, mostly aboard a destroyer escort in the Pacific theater. . . . **Alfred I. Camhi**, SM '60, of Stamford, Conn., died on January 3, 1992. He was a community leader and president of Vectron Laboratories. Camhi was well-known for his contributions to charitable and civic organizations in Stamford and Norwalk. He oversaw the building of Stamford's Jewish Community Center and helped devise a new plan to improve downtown Stamford. In Norwalk, he involved the company he founded in supporting community development through the Norwalk Chamber of Commerce and helping youth through the Adopt-A-Schools program and a Vectron scholarship for

minority students. Vectron, which manufactures electronics components for industrial use, employs 350 people at its headquarters. . . . **Ken-neth R. Gobeille**, SM '81, of Montreal, Quebec, died on August 31, 1991. He was employed by Provigo Distribution, Inc., as corporate director of industrial relations. He previously held a similar position at General Motors of Canada.

Sloan Fellows

Norman C. Peterson, SM '63, writes: "I now have three unpaid full-time jobs: Doing software reviews for *Science Software*, co-chair of Santa Monica Protective Association, and church work (deacon, trustee, choir....). I work harder since I quit working than I ever worked when I was working [for TRW]." . . . **Richard J. Santagati**, SM '79, has been named a partner with the investment firm of Cooper & Olbrych in Boston. . . . **William F. Spence**, SM '72, reports: "My wife and I arrived in Hong Kong in June, 1990, to take up residence. My new posting as executive VP entails looking after Canadian Imperial Bank of Commerce's interests in Asia. This is a very interesting and dynamic part of the world and we enjoy it immensely." . . . **Thomas J. Kelly**, SM '70, sends word: "This year I became head of Grumman's Space Station interaction activities in Reston, Va. My wife, Joan, is still working on Long Island, so I'm a weekend commuter. It's an exciting program, and I'm enjoying being back in space again." . . . **Thomas M. Potrykus**, SM '82, writes: "I relocated to New Zealand for an assignment with Telecom Corp. of New Zealand as corporate executive for sales and marketing." . . . **Amar Bousba**, SM '73, SM '74 (I), is living in Belgium consulting on products and technology for the Algerian market. . . . **Susan M. Brady**, SM '87, is dean of students at Johnson State College in Johnson, Vt. Previously, she was vice provost at Gettysburg College in Gettysburg, Pa. . . . **Scott R. Bayman**, SM '80, is VP for world-wide marketing and product management at General Electric Appliances. Previously, he was VP for consumer services at the Louisville, Ky.-based company. . . . **Richard E. Disbrow**, SM '65, adds another feather to his cap. He is now chairman as well as president and CEO of American Electric Power Co., Inc., in Columbus, Ohio.

The Association of Alumni and Alumnae at the Massachusetts Institute of Technology has been notified that **Merwin Miller**, '36, of Berkeley, Calif., died on October 4, 1991. There was no fur-

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ther information provided. . . . **Franklin W. Mohney**, SM '61, of New York, NY, died on May 2, 1991, from complications of prostate cancer. He had been ill for two years but managed to work up to the week before he succumbed. He was a consultant and crisis manager and earlier in his career was president of the General Battery Corp. in Reading, Pa. . . . **Roswell L. Derby**, SM '54, of Longmeadow, Mass., died on November 7, 1991. He was a retired senior VP of Heritage NIS Bank for Savings and an extraordinary local civic leader. He served for four years in the Navy during WWII, and was an ensign and naval aviator. In 1964 he became VP at the former Forbes & Wallace, Inc., and in 1972 he was elected senior VP at Community Savings Bank (now Heritage Bank). Starting in 1964 he was active with the United Way, holding several posts and eventually serving as president of the United Way of Massachusetts. He served on a broad array of boards and committees ranging from medical to musical associations. He was a member of several organizations including the Rotary Club, the Chamber of Commerce, Better Business Bureau, and New England Golf Association. He was secretary-treasurer of the corporation at Springfield College and director and advisor at the University of Massachusetts in Amherst.

Senior Executives

Patrick C. Doolan, '87, writes: "In 1990 I moved from British Petroleum to British Steel where I am director of supplies and transport. It's a very challenging role in procurement and transportation of raw materials/finished products in this international industry. I have been pleased to meet with a number of friends on the program when they passed through London." . . . **Mott L.L. Groom**, '85, has opened a U.S./Italy business development consultancy in Rome and has been named president of Gulf Oil Italiana. . . . **Richard R. Smith**, '73, reports: "I became president of Midland Standard, Inc., a Cleveland-based international consulting and engineering company that specializes in the mineral and natural resources industry." . . . From Davidson, Md., **Roger P. Onorati**, '81, sends word: "I started my own consulting business, RTR & Associates, in January 1991. Figured if I could make it during a recession, I'd give MIT the credit. All is well business-wise so far—knock on wood." . . . **Raymond V. McMillan**, '83, writes: "In February 1991, I was

appointed as the manager of the C3I division and executive VP of CTA Inc. CTA is a \$100 million aerospace system corporation headquartered in Rockville, Md. The C3I division is headquartered in Bedford, Mass." . . . From Johannesburg, South Africa, **André Roux**, '87, sends word: "I am still involved in investment and merchant banking transactions with the emphasis on leveraged buyouts, management buyouts, and related venture capital transactions." . . . **Howell A. Breedlove**, '76, reports: "In late 1990, I expanded my business activities with the formation of two new companies—Precision Galvanizing, Inc., and Fourteenth Street Corp., both in Ambridge, Pa. I am president & CEO of these companies as well as for J&L Structural, Inc., which I organized in 1987."

Bernard P. Gryniuk, '85, of Chambersburg, Pa., died on December 28, 1991. He was employed at Ft. Richie as director of engineering from 1974–85, and was later employed at Unisys and GTE. At the time of his death he was director of marketing with Centel Federal Systems of Reston, Va. As a first lieutenant in the Vietnam War, Gryniuk received the Bronze Star. He was a member of several organizations, including the Chambersburg Lions Club. He and his wife operated Camp Robin Hood at Social Island.

Management of Technology Program

Carol Lemlein, SM '83, is manager and software engineer at Teradyne, Inc., in Agoura, Calif. . . . **Julian Nikolchev**, SM '83, is now product manager of the new ventures group at Target Therapeutics in San Jose, Calif. . . . **Richard Norton**, SM '85, has a new position as project manager in the Santa Ana, Calif., office of Griener, Inc., a civil engineering and transportation firm. . . . **Rick Amerson**, SM '89, is now department manager for High Performance Systems Research at the Hewlett Packard Lab in Palo Alto, Calif. . . . **William Curtice III**, SM '91, is now chief of the Training Systems Division at Wright Patterson AFB in Ohio. . . . **Hai-Den Wu**, SM '91, is chief staff of the Manufacturing Division at Chung-Chan Institute of Science and Technology in Taiwan. Recently he has been working on the organization restructuring program and, also, serving as a part-time assistant to the company CEO for strategy formulation. He wrote, "Thanks to MOT!!" for giving him the foundation for his current assignments.—Fay Wallstrom, Management of Technology Program, MIT Rm. E56-304, Cambridge, MA 02139.

XVI AERONAUTICS AND ASTRONAUTICS

From Pacific Palisades, Calif., **C. Robert Gates**, SM '48, writes: "Since my retirement as senior VP international of Northrop Corp., after 34 years, I am doing a little consulting for a small technology-based company, traveling, supporting my wife's growing artistic activities, and riding my Harley-Davidson FXR. We spent time at our places in Palm Desert, Lake Tahoe, and Mexico. There is no lack of things to do, and I easily fill the time that I thought would be so free after retirement. But I love it!" . . . **Tito A. Rodriguez, Jr.**, SM '84, reports: "I spent the last seven years at Hughes Aircraft's Space and Communications Group. As a project engineer I supported various commercial and government satellite programs. I am currently working on an MBA at the Wharton School at the University of Pennsylvania." . . . **Robert A. Summers**, SM '46, ScD '54, writes: "I was recently appointed chief of the Division of Defense Programs and Analysis in the Bureau of Non-Proliferation Policy at the U.S. Arms Control & Disarmament Agency in Washington, D.C." . . . From Ridgecrest, Calif., **Bertha M. Ryan**, SM '55, sends word: "I have retired from the Naval Weapons Center in China Lake, Calif., and am now working for DCS Corp. I am calculating the aerothermal heating and structural heat transfer at the wing/fuselage intersection of the X-30 (National Aerospace Plane)."

James K. Marsteller, SM '47, in St. Louis, Mo., writes: "Jane and I returned to the MIT campus for the first time in almost 30 years last May for the inauguration of Dr. Vest. Afterward, we toured New England for two weeks and attending our first Elderhostel." . . . **Robin Vaughan**, SM '83, PhD '87, reports from Montrose, Calif.: "I am still working in the navigation systems section at JPL. I have recently completed a very successful optical navigation campaign for the Galileo Gaspra encounter. Accurate orbit determination solutions using this data allowed early playback of the science images recently released by NASA. This was the first close-up view of an asteroid." . . . News from **Laurent Bonnaure**, SM '91: "After graduating last August, I became regional manager of the Invest in France Agency in Los Angeles. The agency is a French government agency directly responsible for providing assistance to U.S. investors and bringing advanced technologies and processes to France. The agency significantly assists U.S. corporations by offering information specific to the French business climate, providing full access and maximizing relevant financial and fiscal incentives from both national and local sources, providing assistance to engineer-customized site selection studies, and finding joint-venture partners in France." . . . *Fire From Ice: Searching for the Truth Behind the Cold Fusion Furor* (John Wiley & Sons, 1991) by **Eugene F. Mallove**, '69, SM '70, has been nominated for a Pulitzer Prize in Letters by his publisher.

Andrew W. Lewin, '91, Course XVI graduate student, has been selected to receive a British Marshall Scholarship for up to three years of all-expenses-paid study at any British university. Lewin plans to study for an MBA at the University of Sussex because he thinks it's important for "managers and researchers alike to understand the systems in which their foreign counterparts operate." He has participated in a UROP project at the Space Engineering Research Center, held an internship at Draper Lab, and organized his own UROP project that grew to include 25 individuals with a budget of more than \$30,000 in 1990. . . . **Laurence R. Young**, '57, SM '59 (VI), ScD '62, Course XVI professor, and director of the Man-Vehicle Lab, has been selected by NASA as one of three payload specialists for the 1993 Spacelab flight. All three will undergo intensive training, and when the launch date nears, one will be

Can You Tell Us Anything About Tsien Hsue-shen?

A biography of Tsien Hsue-shen, SM '36, a former professor at MIT, is currently being written for Basic Books, a division of HarperCollins. It will be published after June 1993.

Tsien, who received a master's degree in Course XVI, returned to MIT in 1946 as an associate professor of aeronautical engineering. He was promoted to full professor of aerodynamics in 1947, a position he kept until 1949, when he became the Robert H. Goddard



Professor of Jet Propulsion at Caltech. In 1950, Tsien was accused of being a member of the Communist Party and was deported to China in 1955, where he played a great role in developing the intercontinental ballistic missile program of his homeland.

Former classmates, students, and colleagues of Tsien are encouraged to write to the author, Iris Chang, at 312 Ellwood Beach Drive, Apt. 16, Goleta, Calif. 93117 or to call her collect at (805)685-9804. □

named to fly on the 13-day mission as the prime payload specialist. The others will support the mission from the ground. Young, who will take a leave from the Institute, would be the first active faculty member to fly in space if he is selected. If he is aboard the flight, he will probably experience the phenomena he has been studying for 13 years—space motion sickness. Young and his colleagues from several other universities have designed many experiments to understand how the body's nervous system adapts to weightlessness and the relationship to motion sickness. Several of their experiments will be aboard the Space-lab.

Donald C. Fraser, '63, SM '63, ScD '67, former executive VP of the Charles Stark Draper Lab, was nominated by President Bush and confirmed as Deputy Under Secretary of Defense (Acquisitions). Fraser is second in command for all acquisition in the Department of Defense. Under his purview are organizations and agencies such as Defense Research and Engineering, where all R&D for the department is managed. Since leaving Draper Lab last year, Fraser has served as deputy director of Operational Test and Evaluation for Command, Control, Communications, and Intelligence at the Defense Department. . . . The American Institute of Aeronautics and Astronautics has elected several Course XVI graduates to the society. **John G. Borger**, '34, a retired Pam Am World Airways executive, was elected an Honorary Fellow, the AIAA's highest honor, for "lifetime achievements and technical leadership in the advancement of aeronautical sciences in commercial transport aircraft, and for contributions to the development of the commercial air-transportation industry." Several others were selected AIAA Fellows: **Satya N. Atluri**, ScD '69, Georgia Institute of Technology; **Peter M. Bainum**, SM '60, Howard University; **Judson R. Baron**, SM '48, ScD '56, Course XVI professor emeritus; **Thomas C. Betterton**, SM '66, EAA '66, Space and Naval Warfare Systems Command; **David W. Thompson**, '77, Orbital Sciences Corp.; and **Edward M. Greitzer**, the H.N. Slater Professor of Aeronautics & Astronautics at MIT. "Selection of AIAA Fellows is limited to those who have not only distinguished themselves in the field of aerospace, but who show strong potential for leadership in the future," states an AIAA news release.

Lawrence E. Beckley, '42, of Winchester, Mass., died on December 30, 1991. He was executive officer of MIT's Center for Space Research until his retirement in 1978. After graduation, he served as a Navy officer in Washington, administering research contracts, during WWII. Afterwards Beckley returned to MIT where he held various administrative and management positions with the Aeroelastic Research Lab, Instrumentation Lab, and in Course XVI, before helping to establish the Center for Space Research in 1963. He was responsible for administering several millions of dollars to sponsor seed research in space science and engineering fields. He also had a major role in the design and construction of the center's new building between 1966 and 1968 and in 1973 he was appointed the center's assistant director.

XVII POLITICAL SCIENCE

John Frankenstein, PhD '83, writes: "I was recently appointed senior lecturer at the University of Hong Kong. Recent publications include 'China's Asian Trade' in *China's Economic Dilemmas in the 1990's*, released by the U.S. Congressional Joint Economic Committee. A study of the political culture of China-watching, cowritten with **K. Holly Maze Carter**, PhD '77, will be published this year as part of a *festschrift* in honor of MIT Political Science Professor **Lucian W. Pye**. Current research includes a study of the Chinese defense-industrial complex for the Stockholm

International Peace Research Institute." . . . Two MIT faculty members are on *The Boston Review's* new editorial board. **Joshua Cohen**, '70, professor of philosophy and political science, heads the board and is principal editor of the *Review*, a 17-year-old bimonthly magazine devoted to literary, cultural, and political issues. **Charles F. Sabel**, the Ford International Professor of Political Science, is the other board member from MIT.

XVIII MATHEMATICS

From Dedham, Mass., **Dana Fine**, PhD '89, reports: "I'm maintaining my tenuous position as an employee of the Commonwealth, teaching math to freshman business students and senior math majors at what is now UMass Dartmouth. Between the lectures I enjoy caring for my 3-year-old daughter and watching her grow." . . . **Janice Rossbach**, SM '51, writes: "I retired from GTE after 28 years as a communications system engineer. I'm now volunteering at Lewis Middle School in Roxbury, Mass., tutoring math and science and starting up GTE Retirees volunteer program at the school. I'm also working with Soviet immigrants through the Jewish Vocational Service. My husband, **Leo Rossbach**, '51 (VI) just retired from Raytheon after 27 years." . . . In the January 1992 issue we incorrectly worded an honor. Here is another try: **Eric Reissner**, PhD '38, has been elected an Honorary Member of ASME. He was selected for "his profound and lasting mark on international applied mechanics through over a half century of teaching, 300 research papers, and wise counsel at the highest level of ASME." Reissner, professor emeritus of applied mechanics at the University of California at San Diego, taught mathematics at MIT from 1939-1969. . . . **Edward J. Dudewicz**, '63, professor of mathematics at Syracuse University in New York, and four coauthors have been awarded the 1990 Thomas L. Saaty Prize for "Statistical Analysis of Magnetic Resonance Imaging Data in the Normal Brain . . . & Implications for Expert Statistical Programming," by the *American Journal of Mathematical and Management Sciences*. . . . **Lynn Steen**, PhD '65, professor of mathematics at St. Olaf College in Northfield, Minn., has been presented with the Mathematical Association of America's Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service. The Hu Award consists of \$4,000 and a gold cup. Steen is best known for writing *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (National Academy Press).

XX APPLIED BIOLOGICAL SCIENCES

Angela Sotelo, SM '67, sends word from Mexico: "I am working in the Chemistry School at UNAM in the Postgraduate Division of the Pharmacy Department. My research work is in high nutritive mixtures for malnourished infant feeding, and evaluation of the nutritive value of Mexican wild plants, mainly legumes."

XXI HUMANITIES

The Section of Foreign Languages and Literatures has received an award of \$179,520 from the Chiang Chingkuo Foundation to initiate a small, experimental program on Chinese language, culture, and literature. **Yih-jian Tai**, a visiting professor and scholar of classical drama, has been leading the program, which began last September. He has been offering classes in beginning Mandarin Chinese and in classical and modern Chinese literature in translation. . . . **Margery Resnick**, asso-

ciate professor of Spanish at MIT, has been named Faculty Member of the Year by MIT's Panhellenic Association, which cited her for "embodying the spirit" of the group. The association—uniting the four MIT branches of the national sororities Alpha Chi Omega, Alpha Phi, Kappa Alpha Theta, and Sigma Kappa—stands for service and scholarship "through the development of character inspired by the close contact and deep friendship of individual fraternity and Panhellenic life." . . . **Judith J. Thomson**, of the Department of Linguistics and Philosophy at MIT, has been named the Laurance S. Rockefeller Professor in Philosophy. Thomson's appointment to a five-year term reflects her "outstanding achievements in the areas of metaphysics and ethics and her commitment to excellence in education and research," Professor Wrighton, MIT provost, said.

XXII NUCLEAR ENGINEERING

Carlos Villanueva-Moreno, NUE '77, sends word from Austria: "In May 1991, I was appointed scientific attaché at the Mexican Embassy in Austria by the Mexican Secretary of Energy. Among other responsibilities, I am the adviser to the ambassador on technical matters dealing with the International Atomic Energy Agency." . . . **Mather K. Waltrip**, SM '89, writes: "I'm working my tail off as a nuclear ship superintendent at Mare Island Naval Shipyard on a \$25 million project. We're refurbishing and modernizing a nuclear attack submarine, the *USS Salt Lake City*. My wife, Ellen, and I took a wine-tasting class at the Cal-Berkeley extension and love to go wine tasting at the many fine local vineyards." . . . **Richard E. Boraks**, SM '59, sent us a brochure from Connecticut Mutual Life Insurance Co. and CM Financial Associates, his employers. In the brochure's biographical sketch, Boraks, who joined the company in 1963, is cited for his qualifications in providing professional service and counsel on all matters pertaining to business and personal life insurance and estate planning. . . . From Israel, **John R. Wolberg**, PhD '62, writes: "My book, *Conversion of Computer Software*, which was originally published by Prentice Hall in 1983, was translated into Japanese and published by Keigaku Publishing Co. of Tokyo." . . . **Susan E. Plomgren**, SM '88, reports: "I am a research associate and project manager for Imatron, Inc., in Southern San Francisco. Imatron makes the only CT scanner able to detect coronary

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heart disease non-invasively up to 20 years before symptoms appear. Our daughter company, Imatron Industrial Products, has been awarded an FAA grant to put its explosives detector into airports." . . . **Frederick W. Buckman**, PhD '70, has had a title change. He is now president and CEO at Consumers Power Co. in Jackson, Mich. Previously he was president and COO. . . . **Steven P. Yambor**, SM '69, has been selected a general partner at Black & Veatch, in the Ann Arbor, Mich., branch. He will continue in his position as project manager for the engineering and architectural design firm which also provides financial and management services. . . . **K. Keith Roe**, SM '74, NUS '74, has been named chair of Burns and Roe Enterprises, Inc., in Oradell, N.J. Roe joined the company in 1974 and in 1982 was named executive VP with full responsibility for all of the company's operations, including its international offices. He was elected president in 1985 and in 1990 was named CEO and president.

TPP TECHNOLOGY & POLICY, PROGRAM

Daniel R. Saltzman, SM '80, is running for election to the Multnomah County Board of Commissioners in Portland, Ore. He was elected to the Portland Community College Board in 1989 and recently became the chair. . . . **Richard Davies**, SM '84, and Josie Stein were married in January 1991. They have settled in England where Richard works at British Rail on its Channel Tunnel Project. . . . **Yongun Lee**, SM '86, is currently on staff in the Planning and Coordinating Department in the Office of the Chairman of KIA Motors. . . . **Peter Poole**, SM '86, and Nan Hughes were married. Peter is currently pursuing a doctorate in political science at MIT. . . . **Jessica Stern**, SM '88, is a post-doc at the Livermore Lab at the University of California. She is working part-time on the conclusion of her dissertation. She is also working part-time on a project for the verification group at Livermore examining the effect of the proposed chemical weapons ban on the chemical industry. . . . **Thierry de Rycke**, SM '88, is married and the happy father of a young Robin (3 months old). He is working for JP Morgan in Paris in the Global Markets Group. . . . **Philippe Rose**, SM '90, joined ICI in the summer of 1990. Since then he has been working on the system for fault diagnosis that he started to develop at MIT. Professor Kramer and Philippe wrote a paper on this system earlier this year which was presented at the AAAI-91 conference. The system is now finished. It will be installed on an ICI plant in about six months. It was a finalist of the ICI award for creativity and innovation last June.—**René Smith** for Richard de Neufville, TPP, MIT, Rm. E40-252, Cambridge, MA 02139.

STS PROGRAM IN SCIENCE, TECHNOLOGY & SOCIETY

Jill Conway, STS Professor, has been elected to the board of the Knight Foundation. . . . **Leo Marx** and **Rosalind Williams**, MIT professors, participated in a Jerusalem Workshop on "Technological Pessimism" in January. This conference was organized by the Edelstein Center, the Van Leer Institute, and the Cohn Institute. Marx spoke on "Technology as an Attribute of Modernity," and Williams spoke on "Cultural Origins and Environmental Implications of Large Technological Systems." . . . Professor **Theodore Postol**, '67 (VIII), SM '72, PhD '76 (XXII), participated in the ABM Treaty Conference in Washington, D.C., in late October. He and George Lewis were co-authors of "SLCMS—Ignored, Then Stored," in the November 1991 issue of *The Bulletin of the Atomic Scientists*. Postol's paper, "Lessons of the Gulf War Experience with Patriot," appeared in the Decem-

ber 1991 issue of *International Security*. . . . Professor **Merritt Roe Smith** lectured on "The Industrial Background to the Modern Era" at the Connecticut College Center for International Studies last November. He also chaired a session on works in progress at the annual meeting of the Society for the History of Technology in Madison, Wisc. . . . Professor **Charles Weiner** spoke at the New York Academy of Sciences in December. His paper was entitled "Scientists, Science Policy, and the 'Ethics Thing.'"—**Phyllis Klein**, STS Program, MIT, Rm. E51-128, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

Albert A. Morse, '19; January 6, 1992; Temple, Texas
Van Dorn C. Smith, '22; November 16, 1990; Woods Hole, Mass.
John A. Frank, '23; August 25, 1990; Greenwich, Conn.
Masick C. Magarian, '23; January 5, 1992; Fresno, Calif.
E. Curtis Plant, '24; December 31, 1991; Jersey City, N.J.
Charles B. Weiler, '25; December 23, 1991; Coatesville, Pa.
Fay W. Brabson, '26; January 5, 1992; Chevy Chase, Md.
Alfred W. French, Jr., '26; January 7, 1992; Piqua, Ohio
Dwight M. Moore, '27; September 25, 1991; Cypress, Calif.
Frederick W. Willcutt, '27; November 24, 1991; Washington, D.C.
Kenneth A. Clark, '28; December 25, 1991; Santa Barbara, Calif.
N. Hansen Ball, '29; December 13, 1991; Annapolis, Md.
Walker W. Holler, '31; January 5, 1992; Dunedin, Fla.
Katherine S. Burrows, '32; December 19, 1991; Woburn, Mass.
Donald Whiston, '32; January 23, 1991; Kingston, Mass.
Warren S. Daniels, '33; December 31, 1991; Annandale, Va.
Frank F. Gilmore, '33; January 1, 1992; Yarmouth Port, Mass.
Madeline E. Lynch, '33; December 25, 1986; Wellsville, N.Y.
William Niessen, '33; October 10, 1991; Marco Island, Fla.
Raymond W. Smith, '33; January 12, 1992; Kingsport, Tenn.
William E. Dobbins, '34; December 29, 1991; Smithtown, N.Y.
Charles E. Ellis, Jr., '34; December 28, 1991; Reading, Mass.
Katherine Lemon, '34; December 17, 1991; Stanstead, Quebec, Canada
Stanley M. Alexander, '35; December 20, 1991; Weston, Mass.
Beverly Dudley, '35; September 24, 1991; New Hartford, Conn.
Lorin A. Presby, '35; December 17, 1991; Lancaster, Pa.
William E. Abbott, '36; October 22, 1991; Pittsboro, N.C.
Robert Iredell III, '38; December 17, 1991; Akron, Ohio
Lester Kornblith, Jr., '38; January 12, 1992; Sarasota, Fla.
Leo A. Weiss, '39; December 18, 1991
Martin A. Abkowitz, '40; January 26, 1992; Lexington, Mass.
John A. Downes, '41; July 14, 1988; Cagnes Sur Mer, France
Robert L. Purvin, '41; June 19, 1991; Mamaroneck,

PUZZLE CORNER

Continued from Page MIT 55

The 2 th root of 143 is 11.9582607431014
 The 3 th root of 939 is 9.792386145009786
 The 4 th root of 633 is 5.015923768441686
 The 5 th root of 8117 is 6.051723946894983
 The 6 th root of 896 is 3.104926578310817
 The 7 th root of 551 is 2.463729851098231
 The 8 th root of 558 is 2.204597318658172
 The 9 th root of 759 is 2.089425371646355
 The 10 th root of 667 is 1.916075348263711

Other Responders

Responses have also been received from D. Church, D. Eckhardt S. Feldman, M. Fountain, I. Shalom,

Proposer's Solution to Speed Problem

28. One player on the home team hits the first pitch for a home run. Every one else grounds out on the first pitch. The game is called on account of rain after 4 1/2 innings. The home plate umpire makes 1/4 of a call. The ground outs are called by the first base umpire but the plate umpire participates in the decision to call the game. □

N.Y.

Joseph H. Davis, Jr., '42; January 4, 1992; Bath, Maine
William H. Noyes, '44; January 1, 1992; Amesbury, Mass.
William G. Schwartz, '44; February 24, 1989; Reading, Pa.
Walter P. Swain, Jr., '44; January 6, 1992; Plainfield, N.J.
Robert W. Hallock, '45; February 12, 1991; Oyster Bay, N.Y.
Charles H. Hart, III, '45; January 15, 1992; Wayland, Mass.
Charles E. Leising, '46; December 15, 1991; Boiling Springs, Pa.
Daniel D. Streeter, Jr., '46; January 3, 1992; Seattle, Wash.
Mary J. McGlinchey, '47; November 19, 1990; S. Yarmouth, Mass.
Joseph A. Christopher, '48; October 19, 1991; Greenbrae, Calif.
John Kessler, Jr., '48; July 13, 1991; Yarmouth Port, Mass.
Ralph J. Devir, Jr., '51; December 16, 1991; Chatham, Mass.
George B. Duhnkrack, '51; December 16, 1991; Brooklyn, Conn.
Ernest A. Sanlorenzo, '51; January 15, 1992; Huntington Station, N.Y.
John H. Winn, '51; January 6, 1992
John C. Casson, '52; March 23, 1991; Springfield, Ill.
Richard H. Fuller, '54; October 2, 1991; Clearwater, Fla.
John W. Green, '56; June 25, 1991; Livermore, Calif.
N. Andre Boschert, '57; April 13, 1991; Cleveland, Ohio
Joseph H. Arndt, '60; July 25, 1989; Newberg, Oreg.
Alan S. Bloom, '60; February 22, 1991; Denver, Colo.
Alfred I. Camhi, '60; January 3, 1992; Stamford, Conn.
Charles R. Rein, '62; February 12, 1991; Pearl River, La.
Humphreys T. Turner, '63; July 17, 1989; Baton Rouge, La.
Lewis Erwin, '72; December 15, 1991; Winnetka, Ill.
Roger L. Renshaw, '77; January 27, 1992; Long Beach, Calif.
Bernard P. Gryniuk, '85; December 28, 1991; Chambersburg, Pa.

Coriolis Aloft

By the time you read this article I will be packing for Australia! The International Symposium on Computer Architecture is being held there this year. I chaired the program committee and am anxious to see if my committee did a good job in selecting papers. But of course I am even more interested in seeing the southern cross! As you can probably tell, I have never crossed the equator before. I was planning to empty a bathtub on the plane to watch the circling water get confused but, alas, the airlines would have none of it (bathtubs fit neither under a seat nor in an overhead rack).

Problems

M/J 1. We begin with a Bridge problem that Winslow Hartford sent us from the *London Sunday Observer*. In the hand shown, West missed the killing diamond opener against 7H and instead lead the spade jack. How can South now make the grand slam?

North		East	
♠	Q 9 5	♠	K 6 4 3 2
♥	10 6 5 3	♥	9
♦	A Q	♦	K J 9 7 4
♣	J 8 7 2	♣	5 3

West	East
♠ J 10 8 7	♠ K 6 4 3 2
♥ 4 2	♥ 9
♦ 10 9 6 5	♦ K J 9 7 4
♣ 9 6 4	♣ 5 3

South	
♠	A
♥	A K Q J 8 7
♦	3 2
♣	A K Q 10

M/J 2. Gordon Rice is thinking of four positive integers

$$0 < A < B < C < D$$

that have a curious property. When numbers are written in base D

$$AB = A \pmod{C}$$

$$\text{and } BA = B \pmod{C}.$$



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: GOTTLIEB@NYU.EDU

For what values of D do solutions exist? Are they unique? Note that AB does not represent $A \times B$. Instead it signifies juxtaposition, e.g., if $A=24$ and $B=345$, AB is 24345.

M/J 3. Daniel Morgan wants to know the expected point count for a randomly dealt Bridge hand of 13 cards? High cards are valued as Ace=4, King=3, Queen=2, and Jack=1. In addition a void (no cards in a suit) contributes 3 points, a singleton contributes 2, and a doubleton contributes 1.

Speed Department

Speedy Jim Landau wants to know the smallest possible number of pitches in a complete baseball game and how many calls does the plate umpire make during this game?

Solutions

JAN 1. Our "first" problem is a computer offering from Bob High. Write the first n numbers in alphabetical (dictionary) orders as they are spelled out (i.e., one, two, three,...one million,...). To avoid ambiguity, use no "ands" or hyphens, so 837,301 would be written "eight hundred thirty-seven thousand three hundred one." 1,897 is "one thousand eight hundred ninety-seven," not "eighteen hundred ninety-seven." Define two functions, $F(m,n)$ and $G(m,n)$ as follows: $F(m,n)$ is m th number in the alphabetical list of the first n numbers; $G(m,n)$ is the position of the number m in this list. (For given n, F and G are inverses.) we ask: (1) What is $F(1,000, 1,000,000)$? What is $G(1,000, 1,000,000)$? (2) What is $F(1,000,000, 1,000,000)$? What is $G(1,000,000, 1,000,000)$? (3) For what numbers n is $F(n,n) = G(n,n) = n$? List the first dozen.

Speedy Jim Landau sent us a detailed solution to this problem and an extension of it. Interested readers should write to Faith Hruby at TR for a copy. A summary of Landau's solution follows: Consider the numbers beginning "eight." There are, in alphabetical order:

number	quantity
eight	1
eighteen	1
eighteen thousand xxx	1,000
eight hundred xxx and	100
eight hundred thousand xxx	100,000
eight thousand xxx	1,000
eighty	1
eighty x	8
eighty thousand xxx	10,000
eighty two	1
	112,112

The case of leading "one" is different because "one million" must be included and the two-digit

and five-digit numbers beginning with the digit one fall alphabetically under the second digit (e.g., "eighteen").

Now we are ready to start answering questions.

(1) What is $F(1000, 1M)$?

$F(1002, 1M)$ is "eighteen thousand two," which is the highest number alphabetically in the "eighteen thousand" series. Working backwards, $F(1000, 1M)$ is "eighteen thousand twenty two" and $F(1000, 1M)$ is "eighteen thousand twenty." [Landau's full situation also tabulates numbers with other leading digits. He then proceeds:] What is $G(1000, 1M)$? The "one thousand" series falls at the end of the "one" series, which means $G(1xxx, 1M)$ runs from 549,552 to 550,551. Since 1000 falls at the beginning of the "one thousand" series, $G(1000, 1M)$ is 549,552.

(2) What is $F(1M, 1M)$?

"Two" sorts highest alphabetically, and can only be followed by "hundred" and "thousand." The last number alphabetically is $F(1M, 1M) =$ two thousand two.

What is $G(1M, 1M)$?

The "one" series goes

one
one hundred xxx
one hundred thousand xxx
one hundred twenty, twenty two, and two
one million
one thousand xxx

Using the answer to (1), we find $G(1M, 1M) = G(1000, 1M) - 1 = 549,551$.

(3) For what n does $F(n,n) = G(n,n) = n$?

There are exactly 64 such n. The first 4 such n are:

one
two
two hundred
two hundred two

Notice the pattern 2, 200, 202. It will repeat itself below. The next 4 n are:

two thousand
two thousand two
two thousand two hundred
two thousand two hundred two (which is $F(1M, 1M)$ above)

There will be no new n until we find a suffix for "two" which sorts alphabetically higher than "thousand." The first such is "trillion." The next 8 n are:

two trillion
two trillion two
...
two trillion thousand two hundred two

JAN 2. Robert Bart offers the following extensions to an old problem from Nob. Yoshigahara. What is the smallest positive integer whose square root has a decimal expansion beginning with ten distinct digits. Now consider cube roots instead of square roots. Finally consider ith roots for $i = 4, 5, \dots, 10$.

Daniel J. Weidman not only solved this problem but, as with Landau above, extended the problem and solved the extension. Once again interested readers should contact Ms. Hruby for a copy. Weidman's solution to the original problem follows. Note that we are interpreting the "decimal expansion" to begin after the decimal point.

Continued on Page MIT 54

MIT LIFE INCOME FUNDS

JOHN M. CAMPBELL

HOME: Bloomfield Village, Michigan

CAREER: In 1926, on the strength of a recommendation by Professor R.T. Haslam, who was then director of the MIT School of Chemical Engineering Practice, Mr. Campbell, CH '25, joined the General Motors Research Laboratories. For the next 25 years, he and his associates discovered, developed and promoted high-octane fuels and high-compression engines to improve the efficiency of the internal combustion engine—that is, giving it more power and more miles per gallon. During World War II, he was a full-time civilian member of an advisory committee to the military on fuels and lubricants.

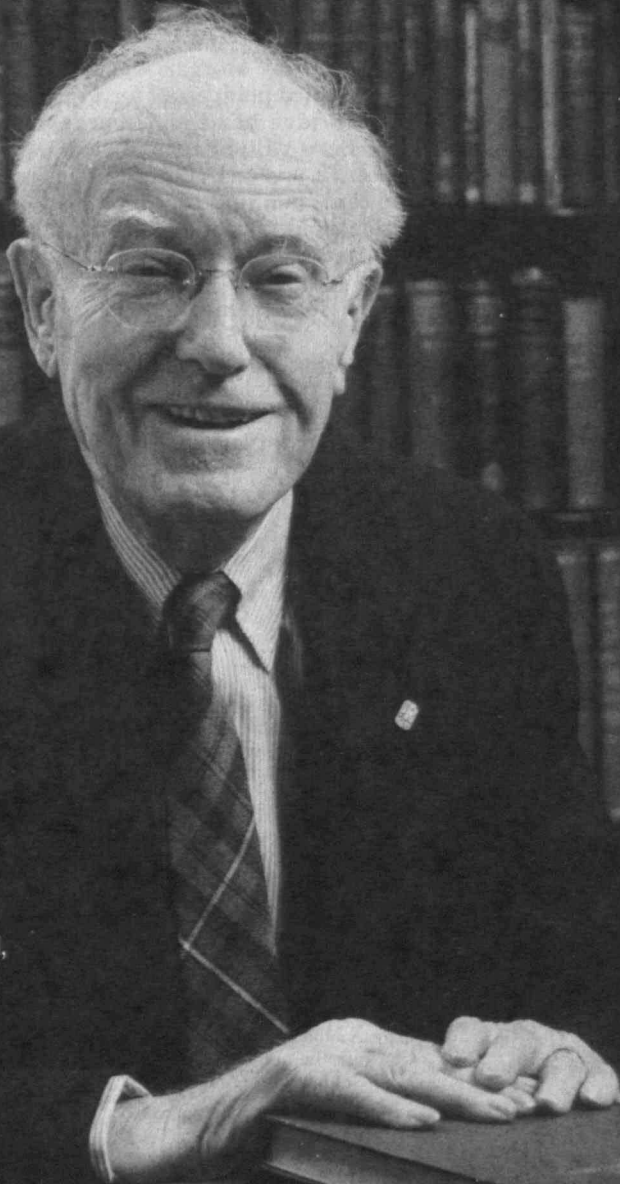
In 1950, when it was recognized that automotive exhaust was an important component of the problem, he turned his attention to Los Angeles smog. He chaired an industry-wide committee that organized a concerted national attack on air pollution. Its efforts resulted in modifications of gasoline composition, engine design and exhaust systems. In 1955, he was named the scientific director of the GM Research Laboratories, where he remained until he retired in 1968. Mr. Campbell is a Founding Life Sustaining Fellow of MIT.

GIFT OF CAPITAL: Charitable Remainder Unitrust to establish the John M. Campbell (1925) Undergraduate Student Loan Fund.

QUOTE: A charitable remainder gift to MIT is like having your cake and eating it, too. My wife Marie and I receive a lifetime income that is almost double what we formerly earned from the same amount of capital and, of course, there is no capital gains tax. It is also an excellent way to return some of the profit that comes from an MIT education and to assist the next generation of technologists.

For more information about gifts of capital, write or call Frank H. McGrory or D. Hugh Darden at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Larry Rice, Sterling Heights, Michigan



DONOR'S PROFILE

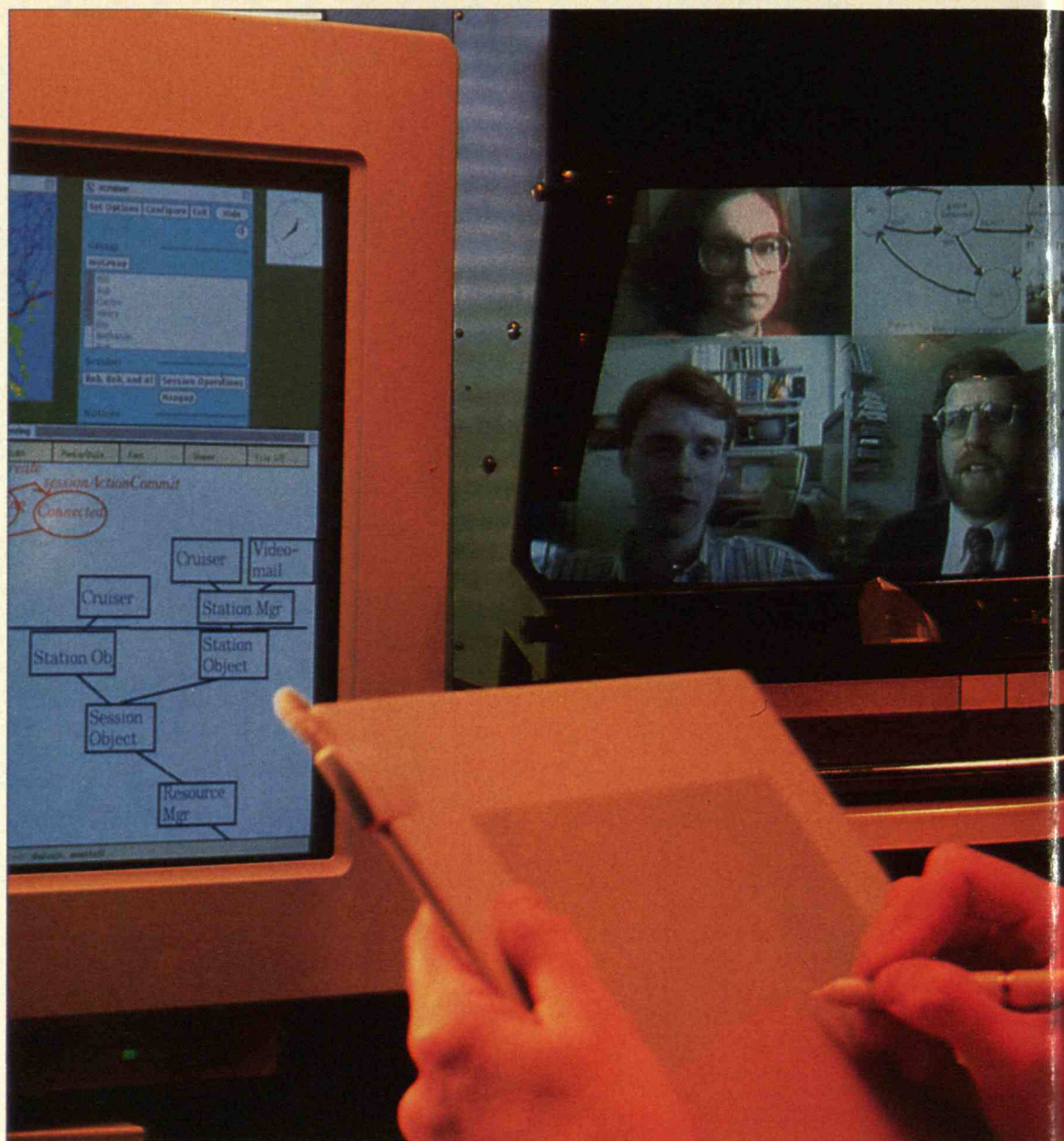
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*Experiments in combining voice and data
with video could bring richer communication to desktops—
and redefine “the office.”*



With Cruiser—a computer-controlled video and audio communication system—Bellcore researchers are studying ways to bring people face to face with distant co-workers.

Being There

THE PROMISE OF MULTIMEDIA COMMUNICATIONS

By DAVID BRITTAN

WHEN Chris Turner's grandmother bought her first TV set, back in 1954, she would nervously cover up the screen whenever it wasn't on. The Orwellian powers she ascribed to the new medium were, of course, well beyond the technology of the day. But Turner has worked hard to change all that, and will tell you that life in a world of two-way video isn't half bad.

When he arrives at his job each morning at Olivetti Research Laboratory in Cambridge, England, Turner clips on an electronic badge that links him to the lab's experimental video and audio communication system, known as Pandora. The badge emits infrared signals that allow his fellow research engineers to find him whenever they want to chat. Once paged, Turner can sit down at the nearest computer terminal and begin a conversation with up to five other people, whose faces show up in different windows on the screen.

Thanks to Pandora's "video news server," Turner can also click an icon on his screen to catch recorded BBC news and weather reports. He can even send video mail. "I might send a message to Ian downstairs—'Are we going out for a beer this lunchtime?'—that he's going to read when he gets back to his workstation in 15 minutes."

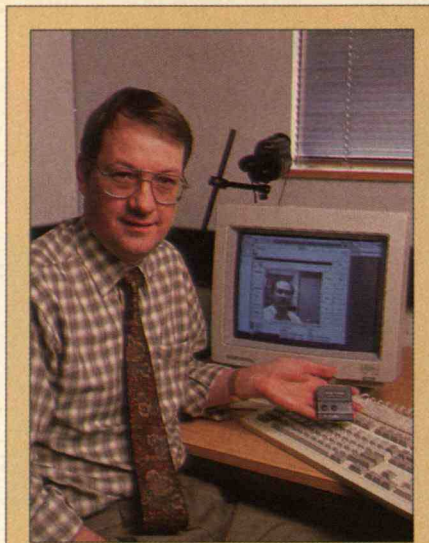
Why do you need to see a video image of someone just to be asked out for a beer? "Well, you don't," Turner admits,

"but don't you think it's rather criminal that you can't?" In his view, the advent of two-way video on computer workstations is a matter of manifest destiny. He insists that as desktop computers grow more adept at combining different media—graphics and audio as well as text—"people are going to ask 'Where's the video?' They'll see that what we do with computers now is akin to selling people cars and only giving them two wheels."

Turner's frustration with the limits of existing media is shared by everyone who works in the burgeoning field of multimedia communications. The Information Age has allowed companies that used to be housed in one location to fan out across the globe. Scientists are almost as likely to collaborate with colleagues on the next continent as across campus. And industrial projects are often so large that those engaged in them couldn't possibly work in close proximity. Yet the technologies that have allowed this migration also saddle users with limitations that were never a problem when intellectual teamwork meant working side by side.

The telephone permits fairly natural conversation, but both sender and receiver must be available at the same time. Electronic mail doesn't provide the immediate feedback people take for granted in ordinary discourse. And even sophisticated products that are labeled multimedia don't let you see the person you're talking to. For example, BBN/Slate, a multimedia system from Bolt Beranek and Newman, enables co-workers to collaborate on documents consisting of text, graphics, and audio. And users of Wang's Freestyle system can annotate an electronic document with speech and handwriting and pass it along to a co-worker, who then sees and hears the comments in the order in which they were made. But without video, important visual cues such as facial expressions, hand gestures, and body language are lost. The illusion of face-to-face contact, after all, requires a face.

Several companies do offer video conferencing systems, some integrated with fax machines and able to display spreadsheets and other text. But most of these systems are bulky and expensive. They also require special rooms, so consultations must be scheduled in advance. In fact, the only technology that lets widely separated people meet, show work in progress, and col-



Chris Turner displays the electronic badge that enables fellow Olivetti engineers to track him down for video chats over Pandora. Future versions of the experimental video system will be in color.

laborate as effectively as if they shared an office is still the airplane.

By bringing two-way video to desktop computers, multimedia researchers hope to recapture some of the flexibility and human warmth that electronic communication has lacked. In this quest they are benefiting from recent technical advances. For instance, compression technology—which reduces the amount of data needed to send video by transmitting only the new information needed for each successive video frame—is enabling higher-quality images to travel over less expensive lines. And the price of video equipment is falling, even as cameras and processors grow in sophistication and shrink in size.

Still, it could be several years before video/multimedia tools land on people's desks, according to Stephen Reynolds, an analyst at Link Resources in New York, which has just completed a major

study of the field. Reynolds predicts that the first successful products will be designed for a single user—software such as spreadsheets and databases annotated with voice and perhaps animated graphics. The next generation of these products will allow sharing over networks. "Video," he says, "will come along a little bit behind that stuff."

If desktop video/multimedia systems aren't exactly busting out of the lab, it's not because people aren't excited about them. "We looked at the consumer market, as well as the business and education markets, and found plenty of interest," says Reynolds. What appears to be holding up commercialization is uncertainty about which features people will find most valuable. For example, will they want systems designed for structured conferences where annotations are done using a keyboard or mouse? Or will they gravitate toward more informal setups, where participants drop in for video chats and scrawl notes on sheets of paper? To compound the problem, nobody knows what sorts of networks will be available to carry the rich new media anytime soon, or how readily users will invest in systems that require so much bandwidth.

As developers wrestle with these uncertainties, they are testing a variety of approaches, trying out assumptions about people's work habits, and refining the technology accordingly. Each project treats video differently. Yet each could play a role in shaping the way we'll work and communicate a few years hence.

Building Rapport

Researchers at AT&T Bell Laboratories in Holmdel, N.J., are pursuing what might be called an egalitarian approach to multimedia communications. "We're trying to develop a model that can access any computer, any set of people," says Sudhir Ahuja, who heads the team developing the labs' experimental Rapport system. The idea is to present "one uniform interface" for e-mail, voice, video, and computer communications and allow people to work with their favorite word processor, CAD system, or financial planning program on virtually any kind of project.

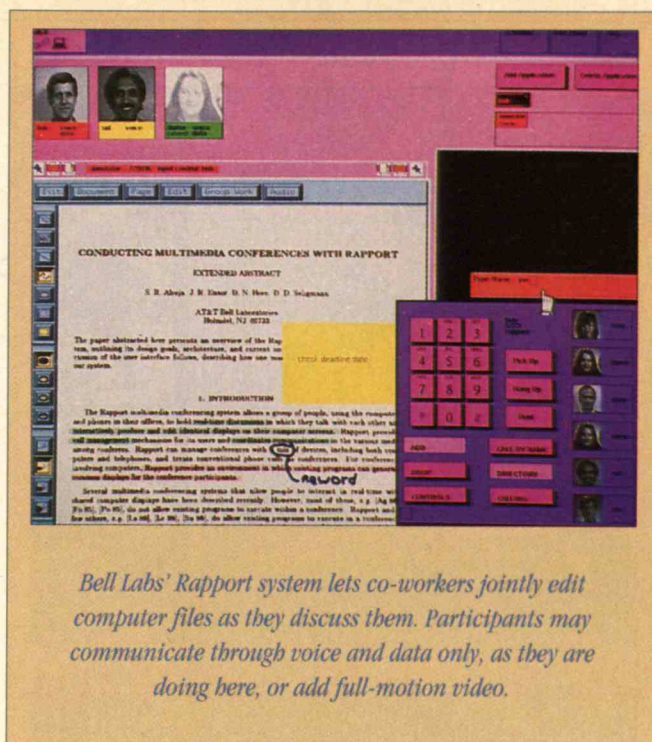
The metaphor Ahuja uses is a "virtual meeting room." To start a Rapport conference, users simply "enter" the meeting room on their screen and call up other people to invite them to join in. What participants see, at least if they're using the full-blown version of Rapport, are video images of the conferees in separate windows on a Sun workstation. The documents they are discussing are displayed in another window. Although only one person at a time can manipulate the software, everyone can see the results. To "raise a hand" or point to various sections of a document, users manipulate a mouse that controls an arrow with their name on it. If someone new wants to join the conference, a "beeper" service alerts the participants.

"In Rapport," says Ahuja, "you can make these virtual meeting rooms hang around for days—go to lunch, come back and continue the meeting, then leave again." Similarly, he says, Rapport lets people switch freely from one conference to another.

The system also has a "store-and-forward" function that can allow meetings to be saved and passed on to other people. An engineering team, for example, might brainstorm on a design, then forward a portion of the discussion across the country to people in marketing, who could add their comments and return the meeting file to the engineers.

In the Rapport approach, live video may actually turn out to be secondary to other modes of discourse. While Ahuja finds prerecorded video useful—Rapport users can show videotape presentations to other participants—he is not convinced that talking heads are the cornerstone of a successful meeting. "What we have found is that video is very good at the start of the conversation, to get a feel for the person," says Ahuja. "But even in a regular meeting, you don't look at the person all the time—you look at the blackboard, you write, you look for information. You make eye contact occasionally, just to test whether the person is paying attention. So it isn't video that dominates a conversation but rather information-sharing." In fact, says Ahuja, the Bell Labs researchers often run Rapport using just voice and data.

Ahuja is now studying ways of tailoring the system to



Bell Labs' Rapport system lets co-workers jointly edit computer files as they discuss them. Participants may communicate through voice and data only, as they are doing here, or add full-motion video.

different needs: executives may want to run Rapport using only notebook computers, while product designers may need powerful workstations, he says.

A Show of Hands

For Hiroshi Ishii, at the Human Interface Laboratories of Japan's NTT, what's missing in systems like Rapport is the familiar desktop, where, even in the late twentieth century, the human hand still makes useful marks on paper. His TeamWorkStation is designed to bridge gaps between the desktop, the personal computer, and telecommunications. The metaphor behind TeamWorkStation is the "open shared workspace": members of a work group ought to be able to bring a wide variety of tools, both old and new, to a cooperative work session and use them simultaneously.

It was this principle that led Ishii to choose video as the basic medium of his research project. At the heart of each workstation is a Macintosh computer with two screens, one for individual work and the other for shared work. A speaker phone and two miniature video cameras—one for faces and one, mounted on a flexible desk lamp, to capture the desktop and the user's hand gestures—provide the audiovisual link.

Two to four people work together, viewing each other in a window of the shared screen. In another window they share computer files, which they grab from their individual screens by dragging a mouse, or books and papers, which they convey by pointing a camera at the desktop. If one person draws a diagram on a piece of paper that shows up on the shared screen, someone else can add to the drawing by sketching on his or her own pad. The participants see a synthesis of the old and the

new, with a translucent image of the hand as it modifies the diagram. They can also point and gesture by placing their hands under the camera.

A disadvantage of this "overlay" approach is that the end product of the collaboration exists only in bits and pieces on different desktops. When people share software, changes are easily incorporated into a document. But when the medium of collaboration is video, users have to go through extra steps, such as making a hard copy with a video printer or storing the document with a video digitizer.

Ishii maintains, however, that not all co-workers need to manipulate the end product. He points to research suggesting that when two people collaborate, one tends to perform a task while the other monitors progress and makes suggestions. In trials at NTT, he reports, "we seldom felt the necessity of editing other people's diagrams directly. If a diagram had to be changed, the originator would usually change it." A major reason for this role division, according to Ishii, is that the second person respects the originator's "ownership" of a document.

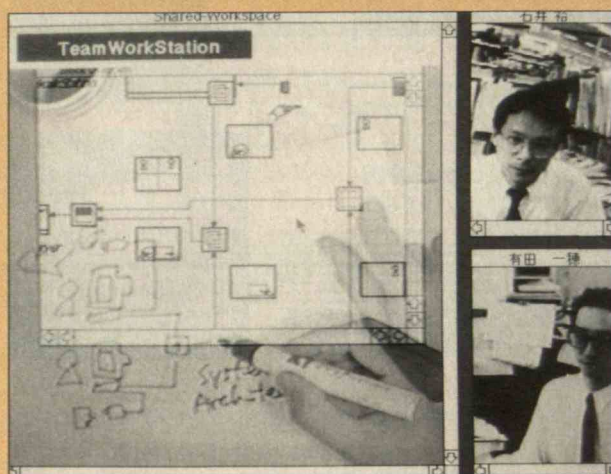
Even though, like Rapport, TeamWorkStation allows people to work together on the same software, Ishii has found that people prefer the video overlay mode. Having used TeamWorkStation to redesign the system itself, Ishii and his co-workers concluded that pointing and drawing with hands was both faster and more expressive than using a mouse. So Rapport and TeamWorkStation appear to be on different tracks, one leading to a system where video creeps in only as needed, and the other leading to a system where video is the vehicle.

The Camera Never Blinks

Xerox Palo Alto Research Center (PARC), from which Ishii got many of his ideas, has ventured even further down that second track. A project called Media Space—intended specifically for collaboration in design work—eschews the shared computer applications possible on Rapport and TeamWorkStation in favor of video alone.

"We see design less as a technical activity and more as a social activity," says PARC researcher Scott Minneman. To the developers of Media Space, computers are too rigid and compartmentalized to allow the social component of design to flourish. "While computer-aided design is very much about precision," says Minneman, "video allows people to negotiate and make ambiguous statements: 'We need this to run longer' or 'That piece needs to be heftier or feel different.'"

Media Space—a project that has been replicated at Rank Xerox EuroPARC in Cambridge, England, and at the University of Toronto—links 25 or 30 offices through workstations outfitted with video cameras and monitors. Although the cameras are always on, they face in whatever direction the users elect to point them.

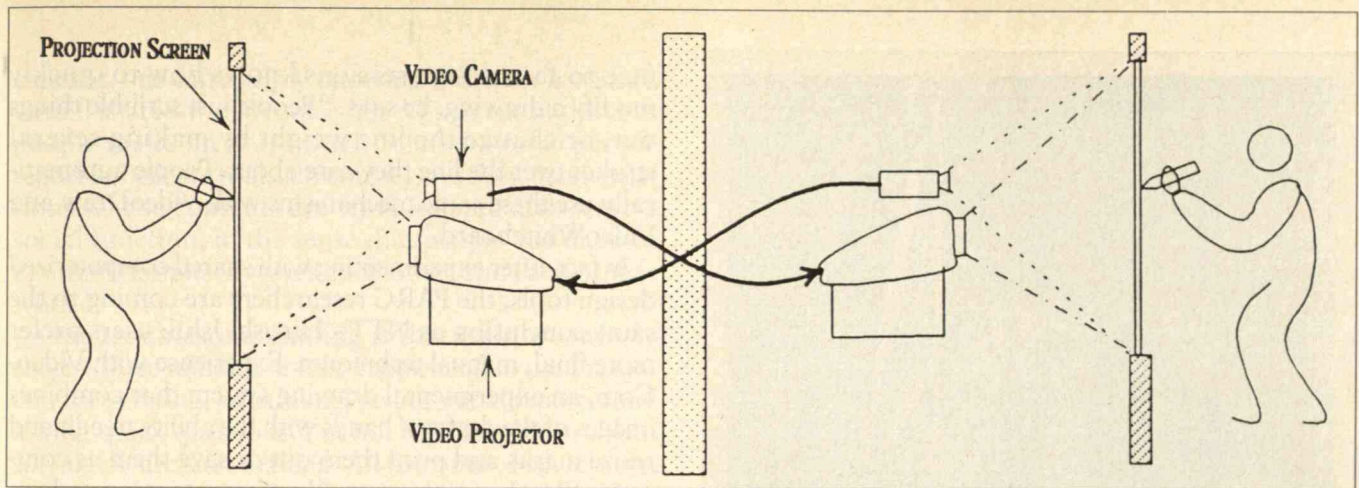


Top:

With NTT's TeamWorkStation, users can transfer work from their individual screen (left) to a "shared workspace" (right) for collaboration. Tiny cameras mounted on the black boom and on the lamp send images of the user's face and desktop to the shared screen.

Bottom:

The system can then superimpose the image of a hand pointing and making corrections onto that of a document lying on a co-worker's desktop.



Half a dozen people can view one another at once. According to Minneman, Media Space has been used successfully for collaborative work within his building as well as between researchers at Palo Alto and another Xerox lab in Portland, Ore.

In the experiment with Portland, monitors were placed not only on workers' desks but in the common rooms of the two sites. If someone in one common room wanted to speak to a colleague in the other common room, he or she would simply yell that person's name. "It's a very casual communications medium," says Minneman. That's also true of the office-to-office connections, he says. "In a lot of teleconferencing systems, the configuration is fixed. But in Media Space, the configuration is totally up to the user. So if you realize that what you want the person to be seeing is a piece of paper on your desk, you simply pull your camera over and aim it at your desk."

PARC researchers have tested Media Space in a number of non-Xerox settings. A 1987 office design project brought together three architects who had never met. Connected only by video images of one another and of their hand-drawn sketches, the architects spent two days hashing out their philosophical differences, drawing and redrawing, and finally producing a workable design. When it was all over, they unanimously reported that the work had gone faster than if they had collaborated in person. One architect found it helpful to see the others' drawings right side up—something that's often difficult when designers are sitting around a table. Perhaps more important was a tendency to remain focused on the work—to "cut out a certain amount of debris that's usually in the face-to-face world," as one designer put it.

But such studies pointed up the need for a shared space in which to draw collaboratively, as in Team-WorkStation's overlay mode. The PARC researchers have responded by building a number of video-based drawing tools while trying to avoid what Minneman sees as a common flaw of interactive systems: the drawing surface is separate from the screen. In PARC's prototypes, he says, "you actually work on the surface where



Above: Pay no attention to that man behind the curtain; he's actually sketching on a remote VideoWhiteboard, a TV projection screen developed at Xerox Palo Alto Research Center for collaborative drawing. Xerox researchers believe that such simple video tools preserve the social element of design better than computer-based drawing programs.

Top: How it's done.

the effects of your actions are appearing. In our experience there's a big advantage to how familiar and comfortable and recognizable that is."

The tools are disarmingly simple. Users of Video-Draw sketch directly on an upward-facing monitor with an erasable marker, and an overhead camera sends the sketch to someone else's monitor. When the other person adds to the drawing, his or her marks—and the hand making them—appear on the original screen.

VideoWhiteboard, another drawing tool, is a high-tech version of shadow puppet theater. Designers at different locations jointly draw on a wall-sized "whiteboard"—a translucent rear-projection TV screen. A camera behind the screen sees silhouettes of whatever marks the person's pen makes, and these are then projected onto a colleague's whiteboard. Because the camera also picks up the shadow of the person drawing, the



Xerox PARC's VideoDraw allows designers to sketch together while viewing each other over the Media Space system. Drawing directly on a monitor reproduces the familiar experience of putting pen to paper.

colleague gets the impression that the drawer is standing on the other side of the screen. The effect is so convincing that in one case a woman who was having trouble hearing what the other person was saying instinctively put her ear closer to the screen—and her colleague spoke louder.

"We've found that people learn to use these systems incredibly quickly," says Minneman, "because there's really nothing to learn—no menus, no mouse, no special tools."

Like TeamWorkstation, VideoDraw and VideoWhiteboard don't let you rotate, resize, or move figures the way sophisticated drafting programs do. But Minneman contends that this is not necessarily a drawback. Anyone who has used pencil and paper in

face-to-face design sessions knows how to quickly modify a drawing, he says. "People just scribble things out, or change the line weight by making several strokes over the line they care about. People automatically use these same mechanisms with VideoDraw and VideoWhiteboard."

In fact, after experimenting with shared computerized design tools, the PARC researchers are coming to the same conclusion as NTT's Hiroshi Ishii: users prefer more fluid, manual techniques. Experience with VideoCom, an experimental drawing system that combines images of the drafters' hands with the ability to edit and resize marks and print them out or save them as computer files, bears this out. "In most situations where we've put this into real use," says Minneman, "we find people spending all their time in the more casual realm." Minneman acknowledges, though, that such findings are inconclusive. "We're suspicious—and I suspect Hiroshi is—that this just means we're not doing it quite right yet."

Chance Encounters

It may be hard to imagine a multimedia approach more casual than PARC's, but Robert Fish and his colleagues at Bellcore in Morristown, N.J.—the research arm of the seven "Baby Bells"—have reduced informal communication to a science. Through a computer-controlled video and audio system called Cruiser, the Bellcore researchers hope to allow far-flung workers to simulate chance hallway encounters or drop-in visits to colleagues' offices. Trial runs of Cruiser are now being set up at a number of universities.

Besides allowing users to make video calls to their colleagues, Cruiser has some special features to promote spontaneous conversations. For example, users can ask the system to set up calls to other people at random, displaying their faces on each party's screen. If neither party wants to visit, the call is disconnected after three seconds. Another feature lets users take one-second glances into different offices to see who's available to talk. (Users can activate a "private" command that blocks incoming video calls.)

Cruiser's developers have seen several types of behavior that are not possible with other media. For example, people often make quick calls in the "glance" mode—especially first thing in the morning and right after lunch—just to get a sense of who is around and might be reachable later. Sometimes, too, callers who find that another party is out will simply keep the video connection open to catch the person when he or she returns. And then there's the "virtual shared office," where pairs of people collaborating on a project stay in video contact for hours at a time, going about their own work but occasionally having a conversation.

With its seeming potential for promoting idle

chitchat, one can't help wondering if Cruiser is really a virtual shared water cooler. Yet 90 percent of the calls people make on it are work-related—or so people report in Bellcore trials. Of course, says Fish, “conversations whose contents are work-related also serve a social function, in the sense that people use them to maintain familiarity with each other and each other's work.”

One troublesome finding is that calls are mostly short—three minutes or less. People tend to use the system for greeting, scheduling, giving status reports, and asking quick questions, but not for complex problem solving or decision making. All too often, Fish reports, users start a conversation on Cruiser, then pick up their papers and take them to a colleague's office for consultation—something that collaborators at remote sites won't have the luxury of doing.

Having arrived at the same crossroads as PARC researchers when they decided to build a “shared drawing space,” Bellcore researchers are outfitting Cruiser with document-sharing tools such as a computer drawing system. But wait—what about the awesome power of video to convey familiar hand drawings? Fish maintains that video's resolution is too low for transmitting detailed documents. Systems like Xerox's VideoDraw are OK for making initial design sketches, he says, because they use markers that make thick lines. “But if I want you to see something I've already done, I have to have the ability to integrate documents that already exist.” Indeed, NTT's Ishii admits that he and his colleagues send detailed documents via e-mail or fax instead of over TeamWorkStation's video links.

Another refinement is meant to allow Cruiser users to approach other people more naturally. Normally when one sees a co-worker 20 feet down the hall, one begins looking for clues as to whether that person is available to talk; the co-worker may avoid eye contact, for example, or seem to be in a rush. “But when somebody made a Cruiser call,” says Fish, “they would connect to you and there would be this full-fidelity, full-resolution image—head to shoulders—sitting two feet away from you, which was pretty darned difficult to ignore.” In other words, Cruiser bypassed the familiar negotiation process. Today users see a postage stamp-size still image of a caller. If they want to visit, they click on the face, and only then does it become a full-size moving image.

As Fish and other multimedia developers have discovered, there is no underestimating the challenges of getting technology and psychology to mesh. Even a simple concept like VideoWindow, a huge eight-foot by three-foot TV screen that provides an informal connection between two sites, has been full of surprises. In trials at Bellcore, VideoWindow has been placed in two common rooms on different floors. The idea is to present the illusion of a window, with microphones and speakers



Bellcore designed VideoWindow as an informal link between separate groups of employees. But the system's life-size images could be used in business conferences, distributed classrooms, and medical consultation.

placed to give the impression that sound is emanating from whoever is talking.

But even a window is a barrier of sorts. Although the researchers witnessed “greetings, extended social conversation, work coordination, and the discussion of new research ideas across the VideoWindow system,” users were only 40 percent as likely to strike up a conversation as people meeting face to face. One reason may be that people normally assume that if they can see and hear someone else, the person can also see and hear them. With VideoWindow, it's possible to be out of camera and microphone range yet still able to detect somebody on screen. What's more, conversations often break down because people are unable to speak privately, a possibility that's usually taken for granted even in a crowded room. It's also hard for users to make eye contact: because the camera is in a fixed location and people are moving, co-workers seldom know whether someone on the other side is looking at them. Finally, it's easier to ignore people appearing in the VideoWindow than colleagues in the same room. Although some of these problems sound like a challenge for Miss Manners, Fish and his colleagues have concluded that a few can be solved by “rethinking how video cameras and monitors are designed and placed in personal communications systems.”

Is It 1984 Yet?

With all the work that remains to be done on multimedia communications, developers hesitate to predict when their projects might assume marketable form. Ahuja, at Bell Labs, gives a tentative figure of “a couple of years” for a commercial version of Rapport. Others

merely note that their technology has been patented, is being closely watched by vendors, and might be available for licensing. "In fact," says Xerox PARC's Minneman, "a lot of the phone companies are really interested in VideoDraw and VideoWhiteboard because they see these systems as ways of selling massive amounts of bandwidth."

Meanwhile, developers are checking out possible obstacles to market acceptance. First, there's the Orwell thing. "To many people, the presence of a video camera in a room is rather too close to Big Brother for comfort," notes an Olivetti research report. "Anyone proposing to exploit video technology will have to take this attitude into account." The report goes on to recommend that users be granted full control over where a camera points and whether it is on.

But can measures such as turning off the camera or pressing a "do not disturb" button shield workers from the eye of an intrusive boss? Only if people feel free to use them, warns Gary Marx, an MIT professor of urban studies and planning who specializes in privacy issues. Some companies now pressure employees to keep their home fax machines and computers on round the clock, he says. Likewise, people who turn off their video cameras might come to be seen as bad corporate citizens. The only real insurance against such monitoring, says Marx, is a corporate climate that gives employees a legitimate choice.

Of course, certain folks are just plain camera-shy. When Olivetti Research Lab demonstrates Pandora for visitors, "some people hate it," notes Turner. "They say 'Oh my God, a camera' as they cringe and run out of the room. But are these the same people who refused to leave messages on answering machines 10 years ago?" Turner maintains that users will grow less skittish as the technology becomes more familiar.

Then there's the "massive amounts of bandwidth" that Minneman was referring to. Bandwidth—the data-carrying capacity a network needs to transmit video and other media—could pose the biggest barrier to making multimedia communications routine. Ahuja says Rapport can be used for "minimal conferences" (voice and data only) over two ordinary phone lines. But video is a glutton for bandwidth. The Ethernet data network so common in the office world has an effective bandwidth of about 6 megabits per second. While the transmission speed of compressed video falls well within this capacity—on the order of 56 kilobits to 1.5 megabits per second—office networks would quickly become saturated if more than a few video calls and other data transmissions were going on at once. Only the newer and more expensive "broadband" office networks, with capacities in the hundreds of megabits per second, will do—and these are still a rarity.

Not unrelated is the question of whether the benefits of setting aside a lot of extra bandwidth for video will justify the costs. Although most developers say they have a gut feeling that multimedia systems will greatly enhance productivity, not everyone is convinced that those gains will come from the bandwidth-hogging video dimension.

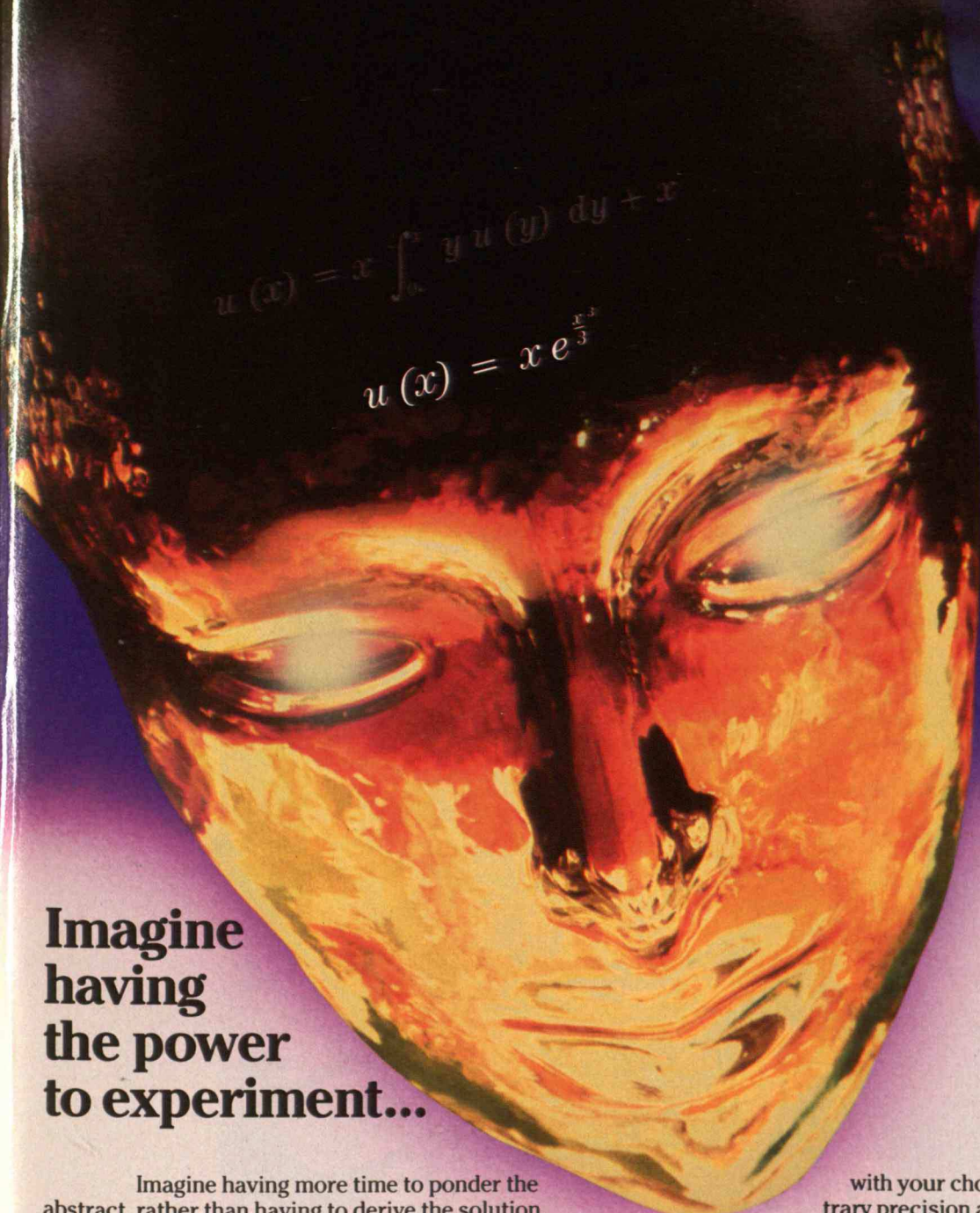
After conducting numerous studies of the way people use experimental multimedia, Robert Kraut, Bellcore's director of interpersonal communications research, concludes that video has special attractions but not special benefits. "We find that people use video a lot—often instead of the telephone. But there's a huge amount of redundancy between the information you can pick up from voice and what you get over the video channel." In fact, he says, faces are much better at deception: people are more apt to "put up a good front, looking confident when they really don't know what they're doing." Considering these drawbacks, says Kraut, "my guess is that people won't pay huge amounts more for video channels than they now pay for telephones."

An even bigger question is how to connect a local multimedia network with networks in other parts of the country and the world. An answer designers frequently proffer is ISDN—the "integrated services digital network" that firms and phone companies are beginning to install for just such purposes. But ISDN is now available only in certain areas, and no one knows how long it will take to expand the system nationally and worldwide.

The spread of multimedia communications tools could hasten such expansion. And in the meantime, says Reynolds, of Link Resources, private companies that offer fiber-optic and satellite links might provide a good alternative to public networks. But because nationwide broadband connections are not yet at hand, he says, "the first successful multimedia networking will probably be done within a company at one site."

What will the world be like when multimedia networks do become ubiquitous? Many observers foresee big changes in the white-collar workplace. Not only will many kinds of business meetings be unnecessary, Reynolds predicts, but so will some commutes. As employees respond to family commitments by turning up the pressure on companies to establish work-at-home policies, he says, multimedia networks will allow corporate sites to shrink: "If you have 15 employees, you might only need room for 10 in the office at any one time."

But powerful as the new tools may be, no one expects them to eliminate the need for human contact. Although in theory desktop multimedia systems could spawn the "virtual company," where everybody works at home, says Ahuja, experience with Rapport has taught him that "there is no substitute for meeting face to face and establishing *real* rapport." ■



$$u(x) = x \int_a^x y u(y) dy + x$$

$$u(x) = x e^{\frac{x^3}{3}}$$

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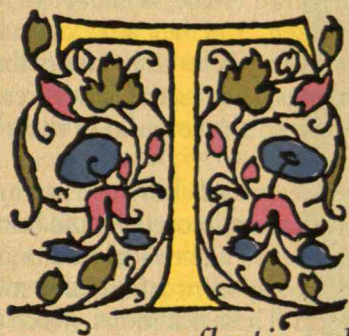
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Hugh of St. Victor, teaching his fellow Victorines. From a thirteenth-century miniature from De arca morali.

A World Without Women

BY DAVID F. NOBLE



THOUGH the past few decades have seen commendable efforts to recruit women into the "masculine" field of science, there has been little reflection about how that field came to be masculine in the first place. For the most part, the exclusive identification of science with men has been taken as a given, something to be overcome, perhaps, but not explained. Yet such a phenomenon demands an explanation. How did so strange a scientific culture emerge, one that confidently proclaims the power of the species while shrinking in horror from half of it?

The evolving but durable male priesthood of science and technology can trace its roots all the way to medieval Christianity.

That culture is rooted in the Christian clerical tradition. During the days when Western science was first starting to grow out of it—that is, during the Middle Ages—the church hierarchy was composed entirely of men and intent on remaking the world in its own half-human image.

This was no easy task. The consolidation of a male-dominated religious environment had already required a millennium of struggle: before the Middle Ages, there were extended periods in which priests married, an androgynous Christian ideal was taken seriously, and women were afforded considerable status. Even once misogyny was firmly entrenched, its defenders still had to deal with revivals of anticlerical feeling, which time and again reopened spaces for women. Thus the fate of women in the Western world of learning has been tied to the recurring tension between orthodoxy and its opponents that has marked the entire history of the Christian West.

What this means is that the male monopoly on science is no mere relic to be easily tossed aside. Throughout most of its evolution, science has not simply excluded women; it has been defined in defiance of women and in their absence. The field has remained an alien world for them, one where they face not just discrimination but dread.

When “Cunning Men” Were Women

However historians might characterize Western science as a secular enterprise, it was always in essence a religious calling, more a continuation of than a departure from Christian tradition. In their own minds, the early devotees of science, toiling away in the ecclesiastical academies of medieval Europe, were not precursors of a secular future but heirs to the Christian past, with which they were obsessed. For example, the thirteenth-century friar Roger Bacon, often identified as a critic of religious dogma and a prophet of modern technology, was in fact interested in neither. Although he explored astronomy, astrology, optics, and medicine—and although he had visions of automata, powered ships, airplanes, and cars—his true quest was for divine illumination. He insisted on what he called the “sacred usefulness” of science for biblical interpretation and the conversion of unbelievers.

Because so many of its early practitioners belonged to the ascetic mendicant orders, Western science took root in an exclusively male—and celibate, homosocial, and misogynous—culture, one centered on the conviction that closeness to God required forsaking the body and

living in a world without women. By the end of the fourteenth century, these “monkish scientists,” as the historian Friedrich Heer has aptly described them, had produced a significant body of knowledge based on newly discovered texts from ancient Greece and enriched by the mathematical and dynamical concepts that they themselves had developed. It was, in essence, a science of the mechanics of motion.

Yet beyond the walls of the medieval monastery, growing religious ferment in the form of the humanist movement had begun to redefine Christianity and create new social spaces for intellectual endeavor. The culture of learning was to alter greatly over the next few hundred years. To be sure, the humanist scholars harbored an aversion to women not unlike that of their intellectual adversaries in the monasteries, but their philosophy also contained opposite tendencies. For one thing, the humanists stressed the education of each individual as a vehicle of Christian virtue, which clearly sanctioned learning for women. And they were less interested in the religious commentary beloved by clerics than in original religious teachings, such as the Scriptures, which were more accessible to those outside the ecclesiastical academy.

In its earnest revival of classical learning as an aid to religious revitalization, moreover, the humanist movement renewed ancient alchemical traditions—teachings that were profoundly spiritual but also solidly based in the natural world. These traditions, which came to exert great influence on Western science, had a strong male bias, too, but like the humanists themselves, the alchemists focused on Scripture rather than commentary. In their fervent search for God’s truth, they also stressed the book of nature over the books of scholars and the lessons of experience over those of formal education. Thus they openly defied the established clerical order, offering the unordained direct, unmediated means of spiritual attainment.

For instance, Paracelsus, the alchemist of the early sixteenth century who was to transform the practice of medicine, roamed far beyond elite circles in his quest for religious and intellectual enlightenment. “The universities do not teach all things,” he wrote, “so a doctor must seek out



Just when they were regaining access to mainstream Western learning, women all over Europe were executed as witches. According to the Malleus Malificarum, the major witch-hunters' manual, they were more than likely copulating with the devil.

DAVID F. NOBLE, professor of history at York University in Toronto, is the author of *America by Design* (Knopf, 1977) and *Forces of Production* (Knopf, 1984). This article is adapted from the book *A World without Women: The Clerical Culture of Western Science* (©1992 by David Noble) to be published in May by Alfred A. Knopf.

old wives, gypsies, sorcerers, wandering tribes, old robbers, and such outlaws and take lessons from them." He and others like him appropriated a great deal of their knowledge from the healing, divining, and other practices of "cunning men"—village practitioners of popular magic who had little to do with the righteous world of the clergy.

It's worth noting as well that most of these "cunning men" were in fact women. Village women were often steeped in animistic pagan and unorthodox Christian magic and herbal lore, passed on orally from generation to generation, by means of which they attended to the pain and suffering of their families and neighbors. These "wise women" appealed to the stars and spirits of nature to divine the sources of mischief and misfortune, distinguish the innocent from the guilty, and prophesy peril and promise.

And with physicians geographically and financially beyond their reach, villagers relied on the services of local healers, surgeons, barbers, and midwives, who tended to be these same women. Along with their store of amulets and charms, they had painkillers, digestive aids, anti-inflammatory agents, and other practical remedies unmatched by university-trained physicians. In short, for many people the time-honored counsel of the wise woman was the soundest guide to the health of body and soul, the most reliable respite from disaster, dispute, and despair.

By the time the sixteenth century was well under way, both the alchemical and the more general humanist movement had gained momentum from the Protestant Reformation and the social upheaval that accompanied it. The Protestants roundly criticized Catholic doctrine, rejected the supremacy of the Pope, and strived to put theology into the hands of the common people. They stressed individual conscience and abolished spiritual mediators, preaching that God spoke personally to those he himself chose. Thus these reformers paved the way for all manner of radical groups.

Indeed, the sixteenth and seventeenth centuries witnessed a veritable explosion of sectarian religious enthusiasm; primarily lower class and artisan-based, these movements were marked by a deep-seated anticlericalism and a social-revolutionary spirit. They held out the promise of deliverance through direct divine illumination, gained with the aid of prophecy, scriptural guid-



*Women
were characterized
more and more
as creatures
of passion
rather than
reason;
as emotional,
irrational,
and merely
intuitive.*



*Village "wise women,"
steeped in magic and herbal lore,
dispensed remedies unmatched by
university-trained
physicians.*

ance, and—although Protestants officially condemned it—the ancient traditions of magic known to wise women. In the wake of this revolt, the current of new naturalistic learning began to flow more strongly than ever outside the confines of the church and the academy, challenging at every turn the inherited conventions of clerical culture.

The result was that for the first time since before the Middle Ages, women became part of mainstream Western thought. Scientific insights were among the most valuable of their contributions. For example, women medical practitioners came into their own, enriching learned traditions with popular ones. Marguerite du Tertre de la Marche, head midwife at the Hôtel Dieu in Paris, recorded her experiments on amniotic fluid and blood serum in an influential obstetrics text. In Germany, Justine Dittrichin Siegemundin of Brandenburg, midwife to the Prussian royal family, published her remedies and observations. And the village wise woman's lore of medical cookery—the essential production of drugs and medicines—underwent a transforma-

tion into the academic fields of nutrition, pharmacy, and botany. In 1666 Marie Meurdrac, an assiduous devotee of the art, published an elaborate six-part work with extended discussions of chemical-laboratory procedures and equipment, the properties of the basic elements, and medical and cosmetic remedies. Defending her publication, she declared to her readers that "minds have no sex."

The artisanal workshop also afforded women a role in the new learning. Historian Londa Schiebinger observes that in this setting, "contributions depended less on book learning and more on practical innovations in illustrating, calculating, or observing," which meant that women definitely had a chance. Moreover, among the disciplines that were treated like a craft in the sixteenth and seventeenth centuries were some that have since been recognized as true sciences, such as astronomy. Women pursued their astronomical labors in family observatories as daughters and apprentices, wives and assistants, independent artisans, and widows carrying on the work of their late husbands. Elisabetha Koopman became the chief assistant to her husband, astronomer Johannes Hevelius, and when he died she edited and published their joint work, an unprecedented catalogue of 1,888 stars. Maria Winkelmann, educated by her father, married Gottfried Kirch, Germany's leading astronomer, and collaborated with him on such important astronomical observations as the aurora borealis, the 1709 conjunction of the sun with Saturn and Venus, and the comet of 1702, for which Kirch alone is mistakenly credited.

Nor were royal women idle. They were superbly situated to gain entry into emergent scientific circles, and they put that power to good use. "With family alliances connecting European courts," Schiebinger points out, "queens served as ambassadors preparing the way for both cultural and philosophical exchange." She notes that "the grand salons of Paris offer unique examples of intellectual institutions run exclusively by women." Noblewomen gathered at such informal academies several times a week to watch experiments and discuss philosophy. It was this kind of extra-academic culture that eventually produced one of France's foremost intellectuals, the celebrated woman mathematician, physicist, and philosopher the Marquise Emilie du Châtelet. "Never was a woman so learned as she," wrote her longtime companion the philosopher Voltaire.

Clerical Culture Renewed

Still, as so often in the near and distant Christian past, the ready identification of diverse social and intellectual movements with women offered the orthodox a sure and time-honored sign of heresy. Women are "the Devil's gateway," the theologian Tertullian had declared in the third century, describing "bold" female sectarians; 1,300 years later, the alarmed

defenders of orthodoxy responded in like fashion to the bold women in their midst.

Executions of so-called witches, almost always women, reached an unprecedented height in the sixteenth and seventeenth centuries. Some estimates place the total number of witch-hunt victims, including those who died in prison, in the millions. In the late sixteenth century, when the wave of gender-bound genocide swept through France, two villages in Trier were left with only one woman each. In Toulouse, 400 women were murdered in one day.

Alchemists, who after all had dared to take women's cures and potions seriously, were likewise condemned. In 1655, over 100 years after the death of Paracelsus, the English divine Richard Baxter memorialized him as "a Drunken Conjuror, who had converse with Devils." The clergy resolutely denied that nature might be a medium of religious illumination. Instead, they elaborated on the mechanical world view their medieval counterparts had developed, withdrawing into the abstract certainties of mathematics and irrevocably divorcing spirit from earth, mind from body, subject from object, male from female. These new men of God sought spiritual and intellectual order, and like their glorious forebears, they found such order, and a lasting refuge, in a world without women.

The august and austere mendicant order of the Minims in seventeenth-century Paris offers a prime example. For Marin Mersenne, a member who proved especially instrumental in reestablishing the male monopoly on learning, mechanistic philosophy was a passion. Such ideas held similar appeal for those who gravitated toward the intellectual social group he created, including his friend and former Jesuit schoolmate René Descartes. A seminal philosopher and scientist, Descartes constructed a coherent scientific system that rendered Mersenne's cherished assumptions explicit, reconceiving the universe as a grand-mechanism in which all spirits save God were effectively removed from nature.

Significantly, too, these intellectual endeavors drew strong support from royal ministries: the unorthodox religious beliefs that were challenging ecclesiastical authority also posed a threat to the political establishment, and Mersenne's circle, examining those beliefs, came to conclusions no member of government would care to argue with. "God sets up mathematical laws in nature as a king sets up laws in his kingdom," Descartes wrote. The Minim order became a staunch defender of the king and maintained close ties to his court, going so far as to claim Louis XIV as its child (on the grounds that his mother, Anne of Austria, had often prayed at a Minim church).

In late-seventeenth-century England, where a radical sect of Protestants had just fomented an unsuccessful revolution, ideas like those of Mersenne and his illustrious cohorts gained particular dominance. Most mem-

bers of the country's premier scientific organization, the Royal Society, energetically, if somewhat anxiously, championed mechanistic philosophy and everything it stood for, while those who might have harbored alchemical aspirations took pains to conceal them. Scientists had to guard themselves against any and all signs of heresy, whether stemming from magic, alchemy, religious sectarianism, or political radicalism.

Accordingly, they emphasized that theirs was above all a masculine undertaking. As an exclusively male retreat, the Royal Society represented a continuation of the clerical culture, reinforced by what might be called scientific asceticism. The medieval monks believed that salvation was impossible unless they denied their sexuality and therefore eschewed contact with women; the scientists stressed that such renunciation was essential to their new form of worship as well. Members of the Royal Society, whether churchmen or not, readily adopted the celibate life.

The physicist Isaac Newton was the disciple who perhaps most clearly epitomized mechanical philosophy and scientific asceticism. Yet it was not as if the whole of his being was consecrated to this ideology. In fact, the tensions of Newton's age were replicated within his very person. On the one hand, he was the paragon of orthodoxy; on the other, as a secret student of alchemy, the occult, and obscure branches of theology, he routinely indulged in heresy. No doubt as a result of this precarious double life, Newton developed a markedly paranoid personality, hiding all evidence of his private preoccupations and maintaining an almost pathologically austere exterior. Not surprisingly, he avoided women like the plague.

These were, sad to say, rather shrewd moves, their psychological cost notwithstanding. For not only were officials quick to enforce disciplinary measures, but Newton had much more to hide than other infidel scientists—he did not simply dabble in alchemy, occult learning, and the study of ancient prophecy as a diversion from his more serious scientific labors or as a way of occupying himself in his dotage. Rather, he spent 30 years, at the height of his



In the eighteenth century, scientifically trained men appropriated the medical knowledge women had been accumulating for generations. Here a male midwife, having pinned a sheet around his neck in the interest of decency, delivers a baby.

IF you're an American girl interested in a math or science career, you'll find few role models, mentors, scholarships, or support systems. And that's on top of the standard fare for girls in many U.S. classrooms, which includes condescension from teachers, sexual harassment from male peers, and textbook images of daredevil men and fragile, do-nothing women. These are just a few of the grim observations from the highly publicized report "How Schools Shortchange Girls," recently compiled by the Wellesley Center for Research on Women.

The report also points to persistent bias against girls on standardized tests, particularly in math and science. For example, the background of mechanical, scientific, and sports-related knowledge that questions commonly assume is rare for girls, and the tests are typically multiple-choice, which is a male forte—girls perform better on essay exams. Researchers note as well that teachers of all subjects favor boys with more critical feedback and interaction during problem-solving sessions.

Myra Sadker, an American University education professor whose three-year study of teaching behavior is highlighted in the Wellesley report, videotaped teacher and student interactions in grades 4, 6, and 8 with her husband David, also a professor of education. They identified four kinds of reactions: praise; acceptances, typically remarks like "okay" that were not followed by substantive feedback; criticism, which ranged from insulting comments to neutral feedback that an answer was not correct; and something called



The Lost Girls

By ARIELLE EMMETT

*Budding female scientists
encounter the glass ceiling as early as
grade school.*



"remediation challenge," where teachers pushed students to get the right answer. "Boys got more responses in every category, and they specifically got much more in remediation, praise, and criticism, where there was clear feedback," Sadker remarks. "We know that clear feedback is related to achievement."

Even girls who do well in math and science during their younger years tend not to choose careers in such fields, says Paula Rayman, a Wellesley associate professor of soci-

ology and director of the Women in Science program at the college's Center for Research on Women. These students frequently lack confidence in their science and math abilities despite their earlier performance.

"All kindergartners are natural scientists," Rayman observes. "They have natural curiosity, and natural inclinations to be scientists." Girls and boys are equally endowed with native intelligence as well. But everything from bad teaching to lack of active encouragement to fam-

ily pressures works to "permanently remove girls from the pipeline," she says. For girls who happen to be black or Hispanic, the problem is just that much worse. They're even more likely than white girls to be overlooked or rebuffed in class.

Camilla Benbow, a psychologist at Iowa State who is conducting a long-term study of gifted women and men, has further documented the loss of talent. She reports that only 1 percent of the girls who rank in the top 1 percent in math test scores at age 12 or 13 ends up pursuing a doctoral degree in math, physical sciences, or engineering. "That compares with 8 percent of the top boys," she says.

Kid Gloves and Double Standards

Elizabeth Ivey, a physicist and provost at Macalester College in St. Paul, Minn., believes that learning styles have a great deal to do with math and science achievement. "For example, girls work very well in groups. They thrive because they're not afraid of being wrong," she points out. But group learning is still more the exception than the rule in math and science classes.

Like Sadker at American University, Ivey thinks teaching styles are part of the problem, observing that while boys are often chastised for wrong answers, girls "get sympathy but not the encouragement to go back and try again." Taft Broome, a visiting professor of engineering at Duke who has conducted a National Science Foundation project on gender and race in science, agrees. He adds that teachers may sometimes

often their criticism because they perceive that girls are less confident. "When dealing with boys, I say to someone doing 'C' quality work, 'I expect better of you.' With a girl, I have to be careful not to hurt her feelings. The net effect can be discouraging."

Paradoxically, while girls may receive the kid-glove treatment in some classes, they are often victims of a double standard in others. Theda Daniels-Race, an assistant professor of electrical engineering at Duke, notes that at the college level in particular, "as soon as a woman opens her mouth, there's a questioning of everything she does, especially in science or engineering. It's a feeling of 'I have to back this up.' You have to be that much more prepared than your male classmates."

Daniels-Race believes that role models can make a difference in keeping girls on an open career track. She herself has beat the formidable odds for women of color in technology, and she points to the fact that she grew up in a family and community where people were "very proud of a black girl even talking about being an engineer." Today she frequently tours schools and science clubs encouraging girls to take advanced courses and learn more about engineering.

The Wellesley report also looks to the future, calling for as many as 40 major revisions in educational approach. The strategies include changing the training of teachers to better meet girls' needs and toughening up school policies on sexual harassment. Notably, however, the authors shy away from one conclusion that many experts say has real merit: separating boys and girls in math and science.

"There's a lot of evidence that girls do better in a single-sex learning environment," Rayman says. "But we're running up against political reality and cultural attitudes. Given the fact that there's a turn toward traditional education and amazing cutbacks overall, to talk about creating single-sex educational environments has a utopian ring to it."

What will it take, then, to give U.S. girls the tools and encouragement to succeed in science and math? Perhaps the answers lie within enrichment experiences like Jayne Kasten's Female Electronic Marvels (FEM) club, a girls-only computing experience that augments Kasten's coed computer club. Kasten, a science teacher at Pattonville Holman Middle School in suburban St. Louis, Mo., encourages girls to experiment with software and then go out and teach applications to other children. FEM has grown from 6 members in 1984 to 60 now, and Kasten has received an Eleanor Roosevelt Foundation fellowship from the American Association of University Women to disseminate the concept to other schools in the area.

"Basically I wanted to make a difference for these girls," she says. "I wanted to help them see that there's something else out there for them." Kasten's efforts go beyond the classroom to include field trips to local science centers. And parents, especially mothers, are invited. "Mothers can be supportive," Kasten observes, "and their daughters can go beyond what they did." ■

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scientific career, immersing himself in such studies. In the course of his alchemical work, which included both textual interpretation and actual experimentation, he wrote over a million words of commentary, which were read only by his closest associates. Most of that commentary remains in manuscript form to this day.

In 1693, largely because of the stress of his work and the cumulative toll of his double life, Newton suffered a nervous breakdown that lasted roughly a year and a half and ended his Olympian scientific creativity. It did not, however, end his influence on history. On the contrary, he pulled himself out of the crisis mainly by consolidating his orthodox persona and turning his considerable energies outward, with the result that he achieved not only near-mythical fame but very real political power. In short order, he became master of the English Mint, president of the Royal Society, and knight of the realm. Historian Frank Manuel notes that he proved himself an "autocrat" who would bend to his will all intellectual "insurgents"—that he "was able to impose on the Western world a personal scientific style and a movement that reflected his character." Newton's famous law of gravity is typical of the stable, ordered universe that this personal scientific style presupposed. According to historian James R. Jacob, the law "provided mathematical demonstration" of "God's working in the world." Here indeed, he observes, "was the ultimate weapon in the war against irreligion."

If in former days scientists were nervous about straying from the straight and narrow, after Newton they hardly permitted themselves to give it a thought. In essence, this was the triumph of mechanistic philosophy, and just as Mersenne had hoped, it signaled the reclericalization of learning. Earlier clerical champions of orthodoxy had insisted first and foremost on mediating between people and God. Now, in the wake of a religious and philosophical upheaval in which people were seeking a more immediate connection with God through nature itself, orthodoxy could not be reestablished without a new form of mediation, this time between humankind and nature.

That more than anything else was the meaning of what has come to be known as the scientific revolution. Linked closely to religious institutions, the emergent scientific establishment constituted a new layer of "clergy." And if the scientific priesthood now disqualified some kinds of knowledge, so they disqualified some kinds of knowledge-seekers, including women. In the eighteenth century, women were characterized more and more as creatures of passion rather than reason; as emotional, irrational, and merely intuitive (psychological terms denoting what once was called heresy, religious radicalism, and unaided revelation). They were deemed eminently unfit for objective science.

In 1727—the year of Newton's death—Madame Lambert, who presided over the Hôtel de Rambouillet, one of the most celebrated of the Paris salons where intellectual women gathered, mourned the passing of a momentarily different world, now irrevocably lost. “There were, in an earlier time, houses where [women] were allowed to talk and think, where the muses joined the society of the graces. The Hôtel de Rambouillet, greatly honored in the past century, has become the ridicule of ours. . . . Cannot women say to men, what right have you to be the guardians of the sciences and fine arts?”

Science survived as a world without women in Europe for well over 100 years after her lament, despite the promise of the eighteenth-century Age of Enlightenment, when progressive-sounding rhetoric was the order of the day. Political control tightened guild regulations, so that artisan women were steadily displaced by their male counterparts.

At the same time, scientifically trained men at once denigrated and appropriated women's knowledge in a wide variety of fields, notably medicine.

Only in the nineteenth century did women begin to regain access to the mainstream of scientific learning. The site of this revolution was the United States, at the farthest frontier of the established order, and at its heart was another lay-sponsored religious revival that spawned a myriad of sects—this time Quakers, Mennonites, and Methodists, among others. As in the past, unorthodox religious enthusiasm defied the authority and misogynous precepts of the all-male clerical hierarchy and enabled women to come to the fore on the grounds of their spiritual equality before God.

The result was a call for greater social equality, including access to higher education. It is no accident that pioneer women's-rights advocates Susan B. Anthony, Lucretia Mott, and Angelina and Sarah Grimke were all Quakers. Nor was it out of character for their compatriot, feminist Elizabeth Cady Stanton, to reserve her most scathing criticism for the clergy, declaring that “our strongest enemies entrench themselves in the church.” Such colleges as Oberlin, Mount Holyoke, and Wellesley were founded by revivalist religious enthusiasts who championed education for women.

But while clericalism was on the wane in the United States, the mechanistic philosophy implicit in Newton's works was gaining dominance. The emphasis in intellectual circles was on the logic presumed to be inherent in



The professional scientists who displaced the clergy nevertheless carried forward its proclivities for a world without women.

the universe—on natural laws. Such laws, moreover, were to be apprehended by professional practitioners of science, who were filling the vacuum in ideological authority left by the decline of the clergy. These practitioners, usually men, founded many influential organizations between 1876 and 1890, including the American Chemical Society and the American Physical Society, as well as the American Society of Civil Engineers and the American Institute of Electrical Engineers. Their members undertook to refashion the universities, and science itself, in their own more exclusive, and exclusively male, image.

Ideologically and culturally, this new “main thrust of science” was all too familiar. As professional scientists legitimized themselves as society's sole authorities in the understanding of life, nature, the cosmos, and a now largely unspoken God, they, like the adherents of mechanistic philosophy in Europe two centuries ago, assumed society's clerical

mantle. Displacing the ecclesiastical establishment at center stage, they nevertheless carried forward its time-honored proclivities for a world without women.

Such a world was presaged, as its past was invoked, at the “Misogynist Dinner of the American Chemical Society.” That remarkable affair was hosted in the summer of 1889 by the society, one of the first and largest of its kind, and according to the record, the evening was spent in song and merriment at the expense of women. One of the final recitations, appropriately enough, was “The Temptation of Saint Anthony,” whereby the brave new men of science betrayed their monastic heritage and its lingering legacy: after cataloging the many kinds of devils that “walk in this world,” the poem concludes that “a laughing woman with two bright eyes is the Worst Devil of All.”

Thus did the women scientists of our own age, still unborn, inherit the ill will that had dogged their predecessors throughout so much of history. That burden is undeniably worth losing. But we bring ourselves no closer to doing so by underestimating its weight, which has been accumulating for millennia. ■

ILLUSTRATIONS:

PAGE 52: FROM *MONASTIC ACHIEVEMENT*, BY G. ZARNECKI; MCGRAW-HILL.

PAGE 54: FROM *WITCHES, MIDWIVES, AND NURSES: A HISTORY OF WOMEN HEALERS*, BY B. EHRENREICH AND D. ENGLISH; THE FEMINIST PRESS.

PAGE 57: FROM *MIDWIVES AND MEDICAL MEN: A HISTORY OF INTER-PROFESSIONAL RIVALRIES AND WOMEN'S RIGHTS*, BY J. DONNISON; HEINEMANN EDUCATIONAL BOOKS LTD.

PAGES 55, 56, 58, 60: FROM *THE MEDIEVAL WOMAN: AN ILLUMINATED BOOK OF DAYS*, BY SALLY FOX; LITTLE, BROWN & CO.

By HAROLD FEIVESON AND FRANK VON HIPPEL



Dismantling the Doomsday Machine

*As the Cold War recedes into history,
the former rivals have an unprecedented opportunity to disarm.
Each side could cut its nuclear arsenal to 1,000 warheads
without sacrificing security.*

THE huge nuclear arsenals of the United States and Soviet Union were built on a fantastic illusion—that nuclear explosives could be used for military purposes by the thousands without destroying modern civilization. Only such an illusion can account for the accumulation of more than 10,000 long-range strategic nuclear warheads and 10,000 tactical nuclear warheads

by each country, with a combined destructive power greater than that of 150,000 Hiroshima bombs.

The principal mission of these oversized strategic forces—to target each other—led to exaggerated fears about the possibility of surprise attacks. This in turn led both sides to place large numbers of nuclear weapons on hair-trigger alert and to disperse authority to launch attacks among large numbers of people, thus heightening the danger of accidental nuclear war. The superpowers' preoccupation with mutual nuclear threats also distracted them from the growing dangers of nuclear-weapons proliferation.

The end of the Cold War offers an unprecedented opportunity for the United States and the former Soviet republics, principally Russia, to begin to cooperatively dismantle the largest part of this Doomsday Machine. As a first step, the arsenals could be cut deeply and quickly to about 1,000 warheads on each side.

By making such deep cuts, the superpowers would acknowledge an important reality: that nuclear weapons are useless as war-fighting instruments. A 1,000-warhead arsenal would be plenty destructive enough to hold the other side hostage, but far too small to mount a large attack on the other's nuclear forces. If both sides cut their nuclear forces to such levels, therefore, neither will feel as much pressure to strike first if a conflict arises. It will become easier to move away from the hair-trigger, "use them or lose them" postures that undermine the stability of the present strategic balance.

The deep cuts would increase the legitimacy of U.S. and Russian efforts to stop the international proliferation of nuclear weapons. They should make it easier to achieve a universal ban on the further production of fissile materials not subject to international safeguards. This ban could cap the arsenals of the middle nuclear powers (Britain, France, and China) and of the "threshold" nuclear-weapons states (Israel, India, and Pakistan). Deep cuts in Russia's nuclear forces, along with similar cuts in its conventional forces, would also help ensure that Kazakhstan and Ukraine stick to their decisions to become non-nuclear states.

A 1,000-warhead force would be consistent with the criteria offered in a recent study commissioned by Air Force Gen. Lee Butler, director of U.S. strategic target-

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ing. The study concluded that in the post-Cold War era, the United States should retain a long-range nuclear force at least as large as that of the Commonwealth of Independent States (CIS) and larger than the forces of Britain, France, and China combined. Thus, for whatever it is worth, the United States would retain its "superpower" status. Finally, a recent study by the Congressional Budget Office shows that a 1,000-warhead force would cost billions of dollars per year less than

the nuclear arsenal that would remain after the more modest reductions already agreed upon in the Strategic Arms Reductions Treaty (START).

A Landslide of Disarmament

The reduction of the superpower nuclear arsenals has already begun. Since the failed Moscow coup last August, a series of reciprocated unilateral initiatives have added up to what Russian President Boris Yeltsin recently described as a "landslide of disarmament." Both countries have already agreed to either dismantle or place in storage almost all tactical nuclear weapons. START will cut their strategic arsenals by thousands of warheads each, and they are negotiating still deeper strategic reductions.

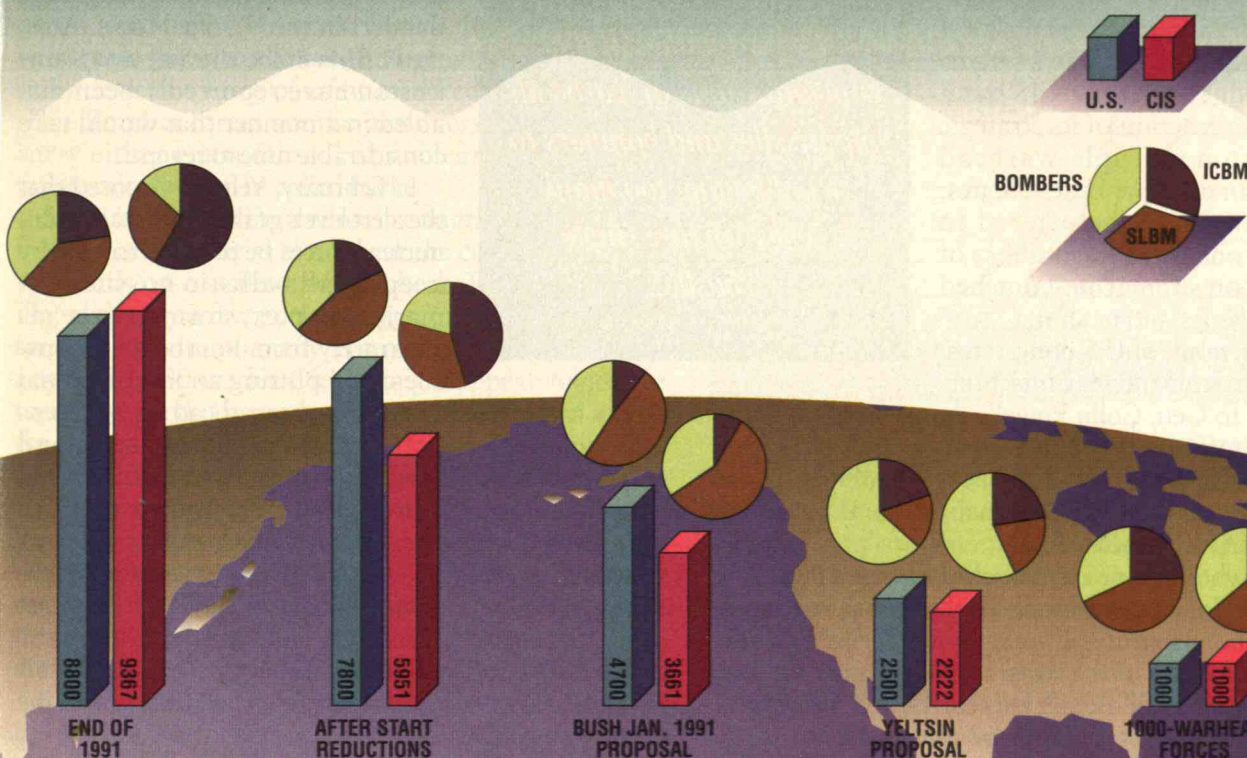
President Bush started the landslide in September by announcing that the United States would denuclearize all Navy ships and submarines except those carrying long-range ballistic missiles, and withdraw from Europe all short-range nuclear missiles and artillery shells. (Fighter-bomber aircraft stationed in Europe, however, will still have available some 700 nuclear bombs.) The United States will destroy more than 3,000 tactical nuclear warheads as a result of President Bush's decision.

Then-president Gorbachev responded with parallel decisions whose implementation went forward despite his fall from power. In December, in Alma Ata, Kazakhstan, the leaders of the CIS agreed that all tactical nuclear warheads would be moved to Russia by July 1, 1992, where they would be dismantled under joint supervision. As of the end of January, Belarus and Ukraine were reportedly the only republics other than Russia that still had tactical nuclear weapons on their soil, and the withdrawals from those republics were ahead of schedule. Gorbachev's decision is expected to result in the destruction of between 10,000 and 20,000 tactical nuclear warheads.

In January, President Bush shifted the focus to strate-

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COMPARING ARMS-REDUCTION PLANS



			END OF 1991	AFTER START REDUCTIONS	BUSH JAN. 1991 PROPOSAL	YELTSIN FEB. 1992 PROPOSAL	1000- WARHEAD FORCES
U.S.	ICBMs	Minuteman III	500 x 3*	500 x 1.8	500 x 1	500 x 1	248 x 1
		MX	50 x 10	50 x 10	0	0	0
			2000	1400	500	500	248
	SLBMs	Trident I	384 x 8	192 x 8	NA	192 x 1	NA
		Trident II	96 x 4	240 x 8	NA	240 x 1	NA
			3456	3456	2300	432	432
	BOMBERS	B52-ALCM	125 x 16	80 x 20	NA	NA	0
		B-1,2	84 x 16	84 x 16	NA	NA	40 x 8
			3344	2944	1900	1568	320
	TOTAL WARHEADS		8800	7800	4700	2500	1000
CIS	ICBMs	SS-18	308 x 10	154 x 10	0	0	0
		SS-19	210 x 6	0	0	0	0
		SS-24	75 x 10	75 x 10	0	0	0
		SS-25	315 x 1	315	315	500	300
			5405	2605	315	500	300
	SLBMs	SS-N-6,8	376 x 1	0	0	0	0
		SS-N-18	224 x 3	224 x 3	224 x 3	224 x 1	NA
		SS-N-20	120 x 10	120 x 8	120 x 8	120 x 1	NA
		SS-N-23	112 x 4	112 x 4	112 x 4	112 x 1	NA
			2696	2080	2080	456	340
	BOMBERS	Bear-H-ALCM	84 x 12.8	84 x 12.8	84 x 12.8	84 x 12.8	60 x 6
		Blackjack-ALCM	16 x 12	16 x 12	16 x 12	16 x 12	0
			1266	1266	1266	1266	360
	TOTAL WARHEADS		9367	5951	3661	2222	1000

*Number of missiles or bombers times the number of warheads carried by each. Bombers loadings are averages. NA: no breakdown available.

gic reductions by renewing his proposal that all multiple-warhead intercontinental ballistic missiles (ICBMs) be eliminated. This time, however, he acknowledged that the CIS has a much larger fraction of its strategic warheads on multiple-warhead ICBMs than does the United States. In compensation, he offered to reduce by one-third the number of warheads on submarine-launched ballistic missiles and to shift a "substantial fraction" of U.S. long-range bombers to non-nuclear missions.

According to Gen. Colin Powell, chairman of the Joint Chiefs of Staff, this would leave the United States with 4,700 strategic warheads—down considerably from the 9,000 warheads expected to remain in the U.S. arsenal after the START reductions.

Yeltsin, who became chief nuclear policymaker after the Soviet Union dissolved, responded that Russia would reduce its strategic arsenals to START levels in three years instead of the seven stipulated in the treaty, and he proposed still deeper cuts to about 2,500 strategic warheads each.

In the meantime, Belarus, Kazakhstan, and Ukraine had all agreed that the strategic nuclear weapons on their territories would remain under central control and declared their intentions to become non-nuclear weapons states and to abide by the Non-Proliferation Treaty. Belarus and Ukraine declared that they would become nuclear-weapons free within the seven-year reduction period laid out in the START treaty. Kazakhstan has vacillated about making the same commitment, but acceptance of President Bush's proposal to eliminate multiple-warhead ICBMs would eliminate all the long-range missiles based in Kazakhstan.

Presidents Bush and Yeltsin further announced that they would halt the development and production of almost all new nuclear weapons. The only continuing U.S. nuclear "modernization" program is completion of the last 6 of 18 Trident submarines and their associated Trident II missiles. However, production of the Trident II's 475-kiloton, "silo-killing" warheads will be halted and the missiles fitted instead with 100-kiloton warheads from retired Trident I missiles.

In parallel with the initiatives to mothball most tactical nuclear weapons, both the United States and Soviet Union have reduced the alert levels of their strategic forces. In September, President Bush ended the three-decade U.S. practice of keeping a fraction of its strategic bombers loaded with nuclear bombs and ready to take off within minutes of warning of a Soviet attack missile. President Gorbachev, in turn, ordered Soviet SS-24 rail-

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"basket."*

mobile ICBMs kept in their bases. (Soviet bombers had never been kept on alert in the U.S. fashion.). Also, the ICBMs in the Ukraine and Kazakhstan have reportedly been disabled in a manner that would take considerable time to reverse.

In February, Yeltsin proposed that the alert levels of the U.S. and Russian nuclear forces be reduced to zero by keeping all ballistic-missile submarines in port, storing warheads separately from bombers and missiles, and putting an international

agency in charge of monitoring the warhead storage sites.

Taking weapons off alert makes perfect sense and greatly reduces the danger of accidental or unauthorized launch. However, both sides need to continue to maintain some forces capable of "riding out" a nuclear attack. Therefore, at least a few ballistic-missile submarines, equipped with stringent protections against unauthorized use, should remain at sea. These subs should have orders to stay safely hidden and await instructions from the surviving political leadership in the event of a nuclear attack.

Traditionally, the principal ambition of the Soviet Union was to achieve nuclear "parity" with the United States. However, the current political leadership of Russia seems to realize—as have Britain, France, and China in the past—that a less-than-equal nuclear force can provide an adequate deterrent. Russian Foreign Minister Andrei Kozyrev stated recently that "the renewed Russia sees no need in maintaining parity and does not want to have as many weapons as the United States or any other power."

In addition, some defense analysts argue that economic pressure will force Russia to make deeper cuts than the United States. However, it is widely believed in Russia that eliminating excess nuclear weapons will, in the short term at least, be more costly than keeping them. It does not cost much to maintain an IBM in a missile silo. Furthermore, statements by President Yeltsin and some Russian military leaders suggest that the historic concern about parity is far from politically dead. Trying to persuade Russia to accept unequal cuts might therefore slow or halt the reduction process. In any case, there is no obvious reason why the United States should not cut at least as deeply as Russia does, or that each should not go down to at least the level of 1,000 warheads.

A 1,000-Warhead Arsenal

In designing the 1,000-warhead force, we have made two general assumptions: First, it is unlikely that either

country will want to eliminate entirely any leg of the strategic triad. Submarines are able to hide under the ocean and survive a nuclear attack. ICBMs are more vulnerable but it would take a huge attack to even partially destroy a force of a few hundred silo-based missiles. Bomber forces are the most versatile—they can carry either conventional or nuclear weapons and, unlike missiles, can be called back.

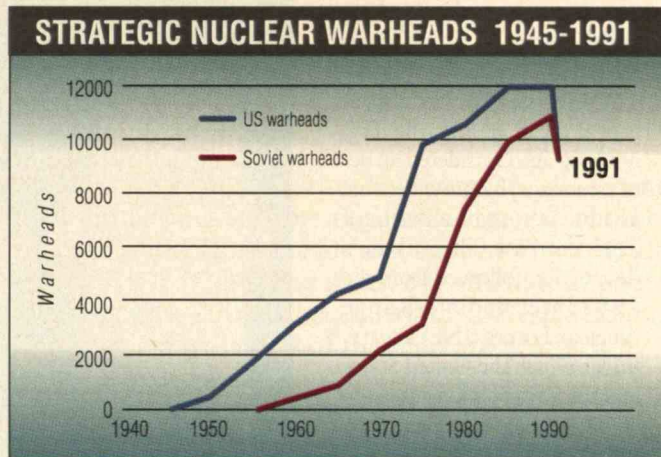
Second, in making radical reductions in nuclear forces, both countries should cut the concentrations of warheads on missiles and bombers. The reasoning is that with only a few nuclear “eggs,” it would be important not to have too many in any single “basket.” Otherwise, a 1,000-warhead force might appear vulnerable to attack—and it is its ensured survivability that makes the small nuclear force work.

The ICBM component of the U.S. force, for example, could consist of 248 Minuteman III missiles “downloaded,” as President Bush has already proposed, from three warheads apiece to one. The obvious candidate for the Russian ICBM is the single-warhead, mobile SS-25, of which approximately 300 were deployed as of the end of 1991. Roughly this number could remain in a 1,000-warhead force. However, mobile missiles depend upon dispersal for survivability, and such dispersal creates troubling security problems. A missile on a truck is not as safe from hijack as one in a silo. Russia may therefore wish to consider placing these single-warhead missiles in some of the silos that will be left empty as a result of the elimination of multiple-warhead ICBMs.

The potential for too many eggs in a basket is even more pronounced with submarines than with land-based missiles. Just two Trident submarines, each equipped as today with two dozen, eight-warhead missiles, would carry almost 40 percent of a 1,000-warhead force. But two submarines cannot ensure robust survivability. If the United States wanted to keep all of its planned Trident submarines, it could download their missiles to a single warhead each, for a total force of 432 warheads. Or the same number of warheads could be carried on a smaller number of submarines with partially downloaded missiles. Russia could similarly download as many as 440 missiles on 25 of its most modern submarines.

To reduce concerns that the stripped-down missiles might be reloaded, the extra warheads should be destroyed in a verified manner. Also, the “buses” that currently direct the warheads of multiple-warhead missiles to their different targets should be eliminated, and tests simulating release of more than the reduced number of warheads banned, as stipulated in the START treaty.

The remaining 320 U.S. warheads could be carried by 40 long-range bombers, each carrying its maximum



What went up now comes down: cuts in nuclear warheads signal the end of the arms race.

internal load of eight cruise missiles. The United States would presumably use B-1 bombers for this purpose and either retire its B-52s or convert them into conventional bombers. Russia could similarly complete its 1,000-warhead force with some of its long-range bombers carrying their maximum internal loads of six cruise missiles each. Surplus cruise missiles would be destroyed, as would pylons that would enable aircraft to carry cruise missiles externally. As today, the bombers would be kept off alert, with their nuclear weapons in storage nearby.

No plausible cheating or breakout from these 1,000-warhead limits could threaten either country's ability to retaliate. In the U.S. case, with current at-sea rates, two-thirds of the Trident submarines would be hidden in the sea at any one time. These subs would carry a total of 288 warheads, each with an average destructive power equal to seven Hiroshima bombs. In addition, at least 50 ICBMs, each carrying a warhead with eight times the destructive power of the Hiroshima bomb, could be expected to survive even a worst-case attack. These surviving warheads would contain a huge destructive potential and constitute a more than adequate deterrent.

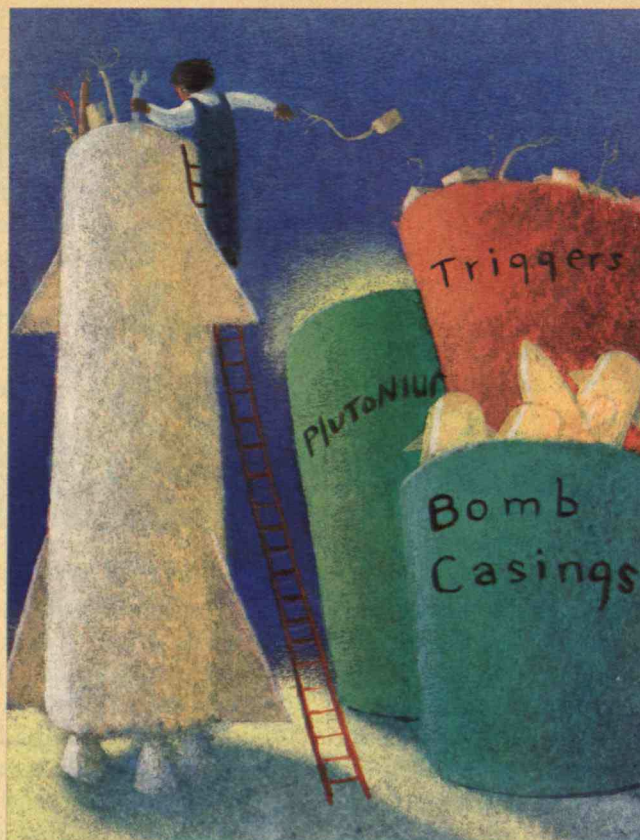
Critics of proposals like ours sometimes assert that a drastically pared-down nuclear force would be incapable of a large “counterforce” attack on the enemy's military. These critics maintain that this would leave a country with only one option for retaliation: the “immoral” one of attacking cities. But a small arsenal does not necessitate attacks on cities. Even after being hit by a nuclear attack, a country with 1,000-warhead arsenal would still have hundreds of surviving warheads, and it would always have the option of retaliating with some of them against military targets. And in any case, massive attacks on military targets would kill so many civilians that distinctions between counterforce

IN May 1991, under the watchful gaze of Soviet observers, the United States destroyed its last intermediate-range nuclear missile. The presence of Soviet inspectors at a U.S. military facility, not long ago considered an act of espionage, has now become an almost routine element of arms control. The missile's destruction followed from the 1988 Intermediate-Range Nuclear Forces (INF) Treaty, under which the United States and the Soviet Union agreed to eliminate all ground-launched missiles of ranges between 500 and 5,000 kilometers, along with their launchers, transporters, missile bases, and support facilities.

To verify previous arms-control agreements, the United States and Soviet Union depended mainly on satellite surveillance. But intermediate-range missiles are small, mobile, and easy to conceal; no picture taken from orbit can reliably distinguish a weapon banned by the INF Treaty from one that it allows.

The treaty therefore took the unprecedented step of stipulating a rigorous protocol of intrusive, on-site inspections. After the treaty went into effect, both parties first conducted baseline inspections of missile inventories, determined the missiles' identifying characteristics, and inspected support facilities. All told, U.S. personnel inspected 133 sites in the Soviet Union, Czechoslovakia, and East Germany while Soviet inspectors made the rounds of 31 facilities in the United States, Belgium, Britain, Italy, the Netherlands, and West Germany.

Before the missiles were actually destroyed, inspectors from the observing country certified that they matched the description provided by the host nation. Inspectors also examined the wreckage after destruction to



Inspecting the Evidence

BY DORINDA G. DALLMEYER

ensure that the missiles were beyond repair. And both sides conducted "close-out" inspections to ensure that the infrastructure required to operate the prohibited missiles had been dismantled.

(Not all the INF missiles were destroyed. A U.S. Pershing II and a Soviet SS-20 now stand side by side in the National Air and Space Museum in Washington, D.C., and fragments of several U.S. and Soviet INF missiles were built into a statue donated by the Soviet Union to the United Nations. The precise geographic coordinates of these now benign missiles have become part of the INF database.)

Until the year 2001, both parties will conduct an annual quota of short-notice inspections at previously

declared locations where the banned INF missiles had been stored or produced. Once either nation specifies a site for inspection, no vehicles large enough to contain a banned missile may leave it. The inspection team must arrive within eight hours and may bring its own measurement devices, including radiation detectors to check for neutrons emitted by missiles in launch canisters. Neutron measurements can distinguish between long-range SS-25 missiles, for example, which have one warhead apiece, and banned SS-20 missiles, which carry three warheads.

Inspectors also will continuously monitor the output of two former missile production facilities, one in the United States and one in the Sovi-

et Union, until 2001. At Votkinsk, 1,000 kilometers northeast of Moscow, the Soviet Union assembled SS-20 missiles as well as SS-25s, mobile intercontinental ballistic missiles not covered by the treaty. The Soviet Union will monitor the Hercules Corp.'s Bacchus Works near Magna, Utah, which formerly produced rocket motors for the now-banned Pershing II missile.

Developing inspection methods sensitive enough to distinguish between banned and permitted missiles without compromising military security presented a challenge. At Votkinsk, inspectors initially planned to weigh railcars to distinguish their contents but abandoned the idea as impractical. Instead, any vehicle large enough to contain a treaty-limited item must stop for inspection at a designated "portal," where an array of infrared lights and sensors produce a profile of the vehicle. If it is too small to hold a treaty-limited item, exit gates automatically open. For larger vehicles, the gates remain closed pending a visual inspection of their contents. A device known as Cargoscan produces an x-ray silhouette of a rocket in its canister to detect the small dimensional differences that distinguish an SS-25 from an SS-20.

At the Hercules plant in Utah, Soviet inspectors visually examine all vehicles with the capacity to carry cargoes larger than a Pershing II rocket motor. If the cargo is shrouded, the inspectors may ask that the shroud be raised. (Although the Soviet Union has a reciprocal right to use an imaging system such as Cargoscan, it has elected not to do so.)

Such highly detailed requirements have resulted in a treaty of unprecedented

complexity. Some 370 pages of documentation specify procedures to get rid of less than 4 percent of the U.S. and Soviet arsenals. In contrast, the SALT I Interim Agreement and ABM Treaty of the early 1970s together totaled only 25 pages. Such complexity can be costly: the United States spends \$9.2 million a year to monitor Votkinsk. The annual budget for the U.S. On-Site Inspection Agency averages about \$40 million.

Military bases and defense contractors' facilities subject to on-site inspection must make costly improvements to protect military secrets. According to the Congressional Budget Office, making communications more secure in the vicinity of the Hercules facility cost nearly \$100 million. A Martin-Marietta facility that formerly produced INF launchers now spends \$5 million before each short-notice inspection to provide easy but secure access to inspectors: the company shrouds sensitive equipment, sends workers home, removes nameplates from doors, and rekeys 2,500 door locks so they can be opened with one master key.

The Strategic Arms Reduction Treaty, or START, will be even more difficult to verify because it imposes numerical limits on weapons. With the INF Treaty's total ban on a class of weaponry, detection of just one missile proves non-compliance. Limits require a much closer accounting not just of bombers, silos, and submarines but also of smaller items such as warheads on missiles, missiles stored out of the view of reconnaissance satellites, and mobile missiles.

The United Nations is

having a difficult time conducting such on-site inspections as part of the demilitarization of Iraq. Many of the problems can be attributed to the coercive rather than consensual nature of the arrangement. But without the opportunity to develop mutually acceptable procedures in advance, U.N. inspectors are having to improvise on short notice. And the United Nations is discovering for itself what the United States and the Soviet Union learned from INF: intrusive arms-control inspection is expensive. The cost of disarming Iraq, estimated at \$800 million, is about equal to the annual combined budget of the U.N.'s major organizations.

Less complex alternatives to negotiated agreements are possible. Over the years, for example, the Soviet Union has declared moratoriums on nuclear testing that are easily monitored by seismic networks in the United States and elsewhere. Unilateral declarations, such as President Bush's decision to eliminate short-range nuclear missiles and President Gorbachev's follow-up proposal, can also avoid the cost and complexity of on-site inspection.

While laudable, such declarations are not legally binding, they may be difficult to verify using only satellite reconnaissance, and they can be reversed. They also may fail to satisfy members of Congress accustomed to requiring strict standards of accountability in relations with the Soviet Union and its successor republics. ■

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and counter-city attacks become nearly meaningless. The deterrent strategy associated with a 1,000-warhead force would therefore be no less moral than the counterforce strategies around which today's forces are designed.

The Bush administration has proposed deploying strategic defenses to protect against accidental launches of up to 200 CIS warheads and against Third World missile attacks. But any defensive shield that could guard against 200 warheads would also raise doubts about the effectiveness of the retaliatory attack by a 1,000-warhead force. Thus any strategic defense system could make deep cuts impossible to achieve.

Other ways to provide similar protection would not conflict with deep cuts. For example, "command-destroy" devices would make it possible to destroy accidentally launched missiles with a coded radio command. As for Third World nuclear threats, the principal focus should be on stopping nuclear proliferation—especially since such nations would probably use methods other than long-range ballistic missiles to deliver a warhead.

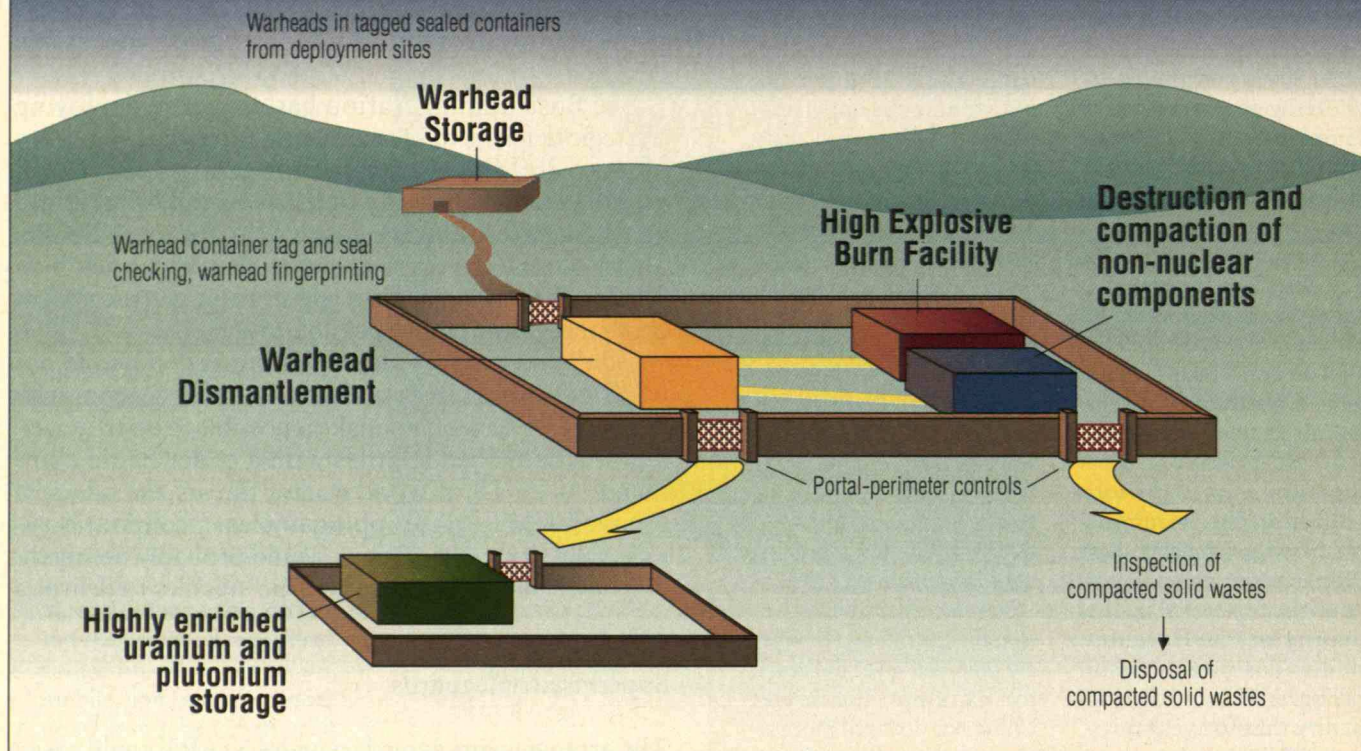
Supervised Safeguards

The arrangements agreed to under START could easily be adapted to verify deeper reductions of bombers, ballistic missiles, and their launchers. The United States and Russia should, however, go beyond START to verify disposal of excess warheads. Verified warhead elimination would reduce concerns about the possibilities of a breakout from a deep-cuts agreement. Even after warhead dismantlement, the recovered fissile materials (plutonium and highly-enriched uranium) must be effectively safeguarded. The technical basis for such an arrangement has been worked out in some detail in a five-year collaborative research project by the Federation of American Scientists and CIS technical experts.

Since dismantling of more than 10,000 warheads by each country will take years, verification should begin by making sure that the warheads to be dismantled are stored at declared locations in sealed and tagged containers. At this stage and throughout the warhead dismantlement process, the United States and Russia would verify each others' commitments. After the fissile materials are removed from the warheads and changed into shapes that no longer reveal any clues on warhead design, the International Atomic Energy Agency could take over as the principal safeguarding authority.

(A more comprehensive scheme would verify not only what warheads were destroyed but also which were kept. It would include declarations of the numbers, types, and locations of all nuclear warheads and the total quantities of fissile materials in the warheads and weapon-complex stockpiles.

SAFEGUARDING WEAPONS DISPOSAL



As each country dismantles and destroys its nuclear warheads, inspectors from the other country would monitor the perimeter of the facility to make sure that fissile material is taken only to safeguarded locations.

President Yeltsin recently proposed that all five acknowledged nuclear-weapon states make such declarations.)

When warheads are delivered to the dismantlement facility, the verifying party would check that the tags and seals were intact and that the neutron and gamma radiation emanating from the container matched the warhead's declared identity. The perimeter of the dismantlement facility would also be monitored to ensure that all fissile material removed from the facility is placed under international safeguards. (See *"Inspecting the Evidence,"* page 66.)

Dismantling warheads and safeguarding their contents should logically be coupled with a halt in any further production of enriched uranium and plutonium. A permanent ban on such production would require the verified shutdown of all military plutonium production facilities and international safeguards on all civilian facilities that contain or could produce significant quantities of fissile materials. The obligation to submit to such safeguards has already been accepted by the approximately 140 non-nuclear-weapon states that have signed the Non-Proliferation Treaty. But while the Russian government has made clear its willingness to

accept these arrangements, the Bush administration wants to retain the option of reusing in weapons all fissile material recovered from dismantled nuclear warheads and even to produce new fissile material for this purpose.

This position is extraordinarily shortsighted. If the United States would forgo the reuse of the fissile materials recovered from warheads that are not to be replaced—thereby "locking in" the U.S. force reductions—Russia would forgo future weapons use of several times more material. Moreover, the world would become a substantially safer place because there would be internationally supervised safeguards against diversion of surplus nuclear warheads and fissile materials by subnational groups.

A U.S.-Russia agreement to permanently end the production of fissile weapons material would have another benefit as well: it would strengthen the legitimacy of U.S. efforts to persuade Israel, India, and Pakistan to halt their production of unsafeguarded fissile materials. Convincing these countries and Britain, France, and China to join in a cutoff would establish the basis for a worldwide ban.

Just Say No to Testing

As a natural complement to a universal halt of fissile weapons materials, the United States and Russia should agree to a comprehensive nuclear weapons test ban (CTB).

In the past, proponents of a CTB have focused on stopping the development of new generations of potentially destabilizing warheads. But the end of the Cold War has largely ended this area of competition, and today the strongest arguments for a CTB relate to efforts to halt nuclear proliferation.

The Non-Proliferation Treaty must be renewed in 1995, and, in light of the Iraq experience, it must be strengthened to provide greater assurances that countries are fulfilling their commitments to forgo nuclear weapons. However, a large number of non-nuclear states made it clear at the 1990 Treaty Review Conference that they will not support a strengthened Non-Proliferation Treaty without a commitment to a test ban.

The Soviet and successor governments have advocated a comprehensive test ban since August 1985, when Gorbachev initiated a unilateral test moratorium that lasted 18 months. Soviet testing halted again in October 1989 when a local citizen movement permanently shut down the main test site in Kazakhstan. The Soviets (and CIS) have conducted only one test since then, on the Arctic island of Novaya Zemlya, in October 1990. This test generated so much public outrage that a formal testing moratorium was declared until October 1992. But the Reagan and Bush administrations have adamantly argued that U.S. testing must continue, principally to develop safer warhead designs.

Nuclear weapons can be made virtually immune to an accidental nuclear explosion without changes that require testing. The principal other hazard is that the chemical explosive in a warhead might detonate accidentally, creating a fine aerosol of plutonium oxide, a potent carcinogen. Almost all the warhead types that the United States plans to keep in its arsenal contain a chemical explosive that cannot be detonated by a fire, the impact of an airplane crash, or even a bullet.

Replacements will be needed for the two or three warhead designs that do not contain such insensitive high explosives. But according to a congressionally commissioned analysis by Ray Kidder, a former nuclear weapons designer at Lawrence Livermore, development of replacement designs that contain insensitive high explosives could be completed before 1995 with fewer than 10 tests.

Some have proposed a new generation of "inherently

Along with dismantling their warheads, the U.S. and former Soviet Union should halt further production of enriched uranium and plutonium.

safe" warhead designs. The plutonium core would be kept inside an armored shell, separate from the chemical explosive until the warhead was armed. But a program to develop such designs would cost billions of dollars and require testing to continue well past 1995. The small residual dangers do not justify such a costly effort.

Eventually, if democracy becomes firmly rooted in Russia and finally reaches China, nuclear deterrence between the current nuclear weapon

states will become as irrelevant as it is now to the relationships between the United States, Britain, and France. Under these circumstances, still further cuts would be possible—to levels constrained primarily by the need to guard against the risk of a rogue nation acquiring nuclear weapons.

How low should we go? One criterion suggested by Herbert York, a former director of Livermore, is that nuclear forces should be cut to such a level that no single person or group could produce damage substantially worse than an all-out conventional war such as World War II. By this standard, the arsenals of the nuclear-weapon states might each retain up to about 100 strategic warheads, with Britain and France perhaps sharing a "European" force.

The nuclear forces of some or all of the members of the U.N. Security Council might then be placed under a joint command. Individual countries could reserve the right to unilateral action in response to a nuclear threat against itself—just as Britain now subordinates its nuclear submarines to NATO except in case of "supreme national emergency."

Further in the future, we hope it will be possible to eliminate nuclear weapons entirely. The alternative—accepting nuclear weapons as a permanent part of the military arsenals of certain nations—would in the long term fatally undermine the effort to control proliferation, since there is no universally acceptable prescription for dividing nations into nuclear-weapon haves and have nots.

The possibility of a nuclear-weapons-free world is just beginning to be taken seriously again. The resulting debate will be complex, challenging us to examine our deepest assumptions about international relations. The United States and Russia could take a major step by reducing their arsenals to 1,000 warheads without stretching too far the currently accepted standards on stability and verifiability. After they take such a step, all nuclear states will be better positioned to explore together how to proceed with further reductions. ■

Reforming Freshman Science

DRIVEN by a possible shortfall of technically trained professionals as well as concern about the low level of general science literacy, U.S. policymakers are obsessed with reforming science education. But underlying most proposed initiatives—and limiting their potential effectiveness—is a set of prejudices about who can do science, why some young people choose science while others don't, and when such career choices are made.

Two of the most deeply held of these prejudices are entwined: first, that scientists are born and not made; and second, that interest, ability, and even commitment to science will show up early if at all. Hence, reform efforts focus almost exclusively on elementary schools (incidentally, the most difficult systems to change) and show relative indifference to recruiting college students to science and retaining them.

"I'm much more concerned about the quality of science and math teaching at the elementary- and high-school levels than I am about the quality at the undergraduate level," said D. Allan Bromley, director of the federal Office of Science and Technology Policy and science advisor to President Bush, in an interview with *The Scientist*. "Students in colleges and universities are much more able to cope with less-than-superb teaching, and if they have been taught at all well, they should be doing a remarkable amount on their own."

Comments like these contribute to what I call the "comfortable-elsewhere focus," which allows the science professorate to evade responsibility for educational reform at its own level. But although there is certainly a group of "first-tier" students who are teacher-proof, curriculum-proof, and classroom culture-proof—able, in Bromley's words, to do "a remarkable amount of work on their own"—there are simply not enough of them to serve the nation's needs in an economy highly dependent on scientific and technological skills.

Between 1966 and 1988, the proportion of college freshmen planning to major in science and mathematics fell



*Introductory college courses
should be magnets for recruiting and retaining science majors,
not filters to discourage the "unfit."*

from 11.5 percent to 5.8 percent. And among those who declare science majors on admissions forms, one-third to one-half leave the fold, often after having been well into the major and sometimes after completing a science degree. Hardly any college students switch from other declared majors to science.

These results could support the prevailing notion that many otherwise intelligent students do not have the aptitude (or the stomach) to stick with a science major, and that the "pipeline" problem has to be handled by means of curriculum reform in the lower grades. But there could be another conclusion: something is very wrong with the quality of instruction in college science, especially at the introductory levels. Consequently, many able students who could have done science are being lost to science—not of their own deficiencies but of ours—relatively late in their educational careers.

Three recent studies support this conclusion. In a small but revealing experi-

ment supported by the Research Corporation (a foundation based in Tucson, Ariz.), six graduate students and one faculty member from fields other than science were asked to enroll in five different introductory college courses in physics and chemistry. The goals were to do as well as they could (all but one did extremely well) and, more important, to keep a detailed record of their observations about the classroom culture of introductory science—the course material, the style of presentation, their own struggle for understanding, other students' attitudes and behavior, and examination and grading practices. These students—all of whom were able, mature, had enjoyed high-school science and mathematics, and represented a "second tier" of would-be science majors—concluded that while college science is "difficult," it is much more difficult, and dull, than it needs to be.

The students found that courses lacked a "story line"—professors offered little overview on which to hang

new concepts or against which to measure progress. The students found fault with a breakneck pace that never allowed them to enjoy mastery for even a little while, and complained that their courses were "mired in a tyranny of technique." It was "all scales and no music," said one. They wished there had been some attention to "how things came to be understood the way they are."

The students said that they hungered for meaningful interactions with their professors or teaching assistants, and for some way to creatively address the courses' material. They found that examinations (which, for the most part, they aced) emphasized regurgitation of facts or standard techniques and, because many science faculty graded on a curve, tended to foster competition instead of cooperation.

Providing a Welcome

In a second study, Abigail Lipson, a senior member of Harvard University's Bureau of Study Counsel, analyzed the experiences of 40 Harvard/Radcliffe "switchers"—students who entered college with a strong aptitude for science but who graduated with nonscience degrees. She reported that many of these students were "repeatedly discouraged" by the "small picture" that they felt was the focus of their science classes. They complained that their instructors treated each formula, fact, or idea in isolation, and they grew impatient with the overly rapid pace and the constant focus on memorization and number crunching. They longed to understand facts in context, to find connections, and to comprehend underlying structures. "But science study at the introductory level rarely allowed for this sort of learning," Lipson concluded.

A third study, by Nancy M. Hewitt and Elaine Seymour of the Bureau of Sociological Research at the University of Colorado, provides another critique of the ideology that science graduates are the surviving fittest. These researchers found little difference in "attributes of character or of ability" among 149

seniors at four Colorado colleges and universities, some of whom had switched out of science, mathematics, or engineering after two or more years in their major while the rest stayed in.

"Most switchers," Hewitt and Seymour wrote in their 1991 report to the Sloan Foundation, "did not have more conceptual difficulties with science and mathematics, or less inclination to work hard, than the nonswitchers." Instead, students made "switching decisions" because of a loss of interest in the subject, work overload, a punishing pace, poor teaching, and an unapproachable faculty.

What made the nonswitchers stay in science, mathematics, and engineering, concluded Hewitt and Seymour (who are enlarging their study to include major universities outside Colorado), is that they had found "ways to deal with some of the problems they shared with switchers," such as study groups or other outside assistance. Adequacy of intellect was not the issue.

The actual dimensions of the shortfall in science-trained professionals may be unclear. But no one disputes the nation's need for more science. To meet that need, these three studies suggest that no college student should be permitted to say "no" to science without a struggle. Professors must shed their comfortable and prejudice-laden views that scientists are born and not made, discontinue hazing and weeding out students who are not deemed to be younger versions of themselves, and transform introductory science courses into opportunities for recruitment and support. Freshman science should become again what it once was: the most exciting, mind-expanding course in the curriculum. ■

SHEILA TOBIAS wrote They're Not Dumb, They're Different: Stalking the Second Tier (Research Corporation, 1991), which reported on the first study described in this article. She is also the author of Overcoming Math Anxiety (W.W. Norton, 1978) and Revitalizing Undergraduate Science: Why Some Things Work and Most Don't (Research Corporation, April 1992); and coauthor, with Carl T. Tomikuza, of Breaking the Science Barrier (The College Board, due out Fall 1992).

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Cool Thoughts on Global Warming

Two important changes have occurred in the global climate debate. The first is that greater emphasis is being given to the scientific uncertainties in relating global climate change to future emissions of so-called greenhouse gases, primarily chlorofluorocarbons, carbon dioxide, and methane. The second is that new studies are showing the economic costs of adapting to climate change to be smaller than initially expected.

Both changes suggest that while the United States should be prepared to move aggressively as new information becomes available, we should not rush to adopt costly new initiatives such as carbon emission quotas or taxes.

Any analysis of global warming is hampered by questions at every step. To begin with, no one is able to reliably predict future worldwide emissions of greenhouse gases, and there are significant uncertainties about the quantity of CO₂ emanating from the biosphere. Even if such predictions existed, deducing the resulting atmospheric concentrations of these gases is not an easy matter, and questions remain about the exact climatic effect of any atmospheric changes. The 1991 report of the Intergovernmental Panel on Climate Change reflects greater uncertainty about the panel's earlier (and widely cited) prediction of 0.3°C temperature rise per decade in a "business as usual" scenario.

Aside from the difficulty of forecasting global climatic changes is the equally important question of the consequences of such alterations, both on human society and on natural ecosystems. The time scale of climate change is critical: adaptation is less difficult if changes occur over centuries than if they occur over decades.

It will be decades before we have a thorough scientific understanding of the effect of greenhouse-gas emissions on global climate. But public policy decisions will not wait that long. At least one segment of the public—the environmental groups in Europe and the United States—believes inaction could prove catastrophic to future generations.

The heart of the global warming pol-

icy debate is that different people have different attitudes about how much resources we should be willing to invest now to lessen the possibility of future catastrophe. Our ultimate concern is the ecological, social, and economic effects of climate change. Recently, William Nordhaus of Yale and other economists have come to some surprising conclusions. They estimate that the economic impact of climate change will be relatively small and the costs of some mitigating actions—dikes, for example—seem manageable.

Nordhaus estimates, for instance, that potential environmental costs of global warming might justify cutting carbon-dioxide emissions by 12 percent, a goal that he says could be achieved by a manageable tax of \$5 per ton of carbon-equivalent emitted. Conventional wisdom holds that environmental costs might justify a 50 percent reduction in

nations that can afford the cost and have the technical expertise to deal with the safety, waste disposal, and non-proliferation problems. These policies have a favorable effect on global warming while contributing to a reasonable national energy policy.

This June in Brazil, at the U.N. Conference on Environment and Development, India, China, Brazil, and others will call upon the developed nations to adopt CO₂ emission targets. These targets will then be used as justification for asking the developed nations to finance new thermal power plants and modernize inefficient older units. I caution against use of emission targets as justification for such costly initiatives, however, because they would divert funds from projects that contribute in a more cost-effective way to a country's overall energy development. This latter approach will of course include projects



emissions, which would probably require a tax of \$100 per ton—significantly hampering economic growth. Nations that did not adopt the tax would enjoy significant economic advantage.

The best policies, I believe, concentrate on actions—such as those encouraging energy efficiency—that cost little and that have other benefits besides helping prevent global warming. Higher gasoline taxes as well as a modest tax on coal, for example, would encourage energy efficiency and yield immediate economic and national-security benefits. I also urge greater use of nuclear power by the United States and other developed

that stress energy efficiency and thus indirectly reduce CO₂ emissions.

In the long term, domestic and international policies must adapt to new scientific information. Fortunately, such rationality is not unprecedented; in the case of chlorofluorocarbons, the United States demonstrated an ability to act decisively once the scientific evidence was in. Policymakers should do as well as they respond to the vexing challenge posed by possible global warming. ■

JOHN M. DEUTCH, Institute Professor at MIT, was formerly provost and dean of science. He has also been undersecretary and director of energy research of the U.S. Department of Energy.

Ill-Equipped for Democracy

THEY are gone now—the Communist Party, the totalitarian state, the command economy, and the sterile rituals of 75 years of Soviet socialism. The world watches nervously as the new republics struggle to create democracy and a market society. Of the many formidable barriers to reform, one casts a distinctly ominous shadow: the legacy of Stalinism. Although eradicated in many areas of social and political life, it is still deeply entrenched in material culture.

For decades the technological style of the Soviet Union featured a bizarre caricature of industrialism. In the Stalinist model, huge was beautiful. Economic progress was measured in the burgeoning size of production facilities and the sheer tonnage of the ore, lumber, and machinery produced. This crude style of technological development was propelled by the desire to overcome poverty quickly and to catch up with the West. A correlate was the Marxist ideal of proletarian collectivism, which seemed to justify designing things for an undifferentiated social mass rather than for individual use. Indeed, within this warped ideology the individual counted for little at all.

The technologies and physical infrastructures that the Soviet Union has left behind—massive mines and factories, enormous collective farms, monolithic public buildings, ecology-destroying irrigation networks, KGB-style computing and communication systems—presuppose centralism, regimentation, and dictatorial control. These attitudes are evident in huge factory cities like Uralmash, where mass production was carried to grotesque extremes and heavy labor consecrated as life's only purpose, and in Moscow's miles and miles of depressingly uniform apartment buildings—the architectural embodiment of political regimentation. Such structures constitute nothing less than a gulag in the material forms of everyday life.

The society that built these inhuman environments is now stuck with them and the ways of living they sustain. An

illustration of this problem recently surfaced as a government official in Moscow complained of troubles in a program to encourage private farming. "The farmers are eager to work," he lamented, "but we don't have the tools and machinery for such farmers. All our equipment is for super-giant collective farms." Without the kinds of plows, tractors, and supplies needed for small-scale agriculture, the new planters face a harvest of misery.

It is all well and good to change the institutional rules to allow for elections and market economics. But these steps will not soon remove the deep imprint of an authoritarian material culture on attitudes, working habits, and organizations. How can one improvise in an iron cage?

In the long term, these oppressive instruments can be replaced by tools and systems more friendly to individual free-

dom and poor documentation on how the plants work, these facilities pose severe hazards even to those who would dismantle them. In Lithuania, for example, the democratic regime is saddled with the problems of Ignalina, a Chernobyl-style nuclear power plant with a history of fires and reported radiation leaks, regarded by international observers as a disaster waiting to happen. Lithuania and the other republics will have to use scarce resources to deal with the technical, social, and environmental problems bequeathed to them by the old regime's material systems.

The atmosphere of inefficiency, breakdown, and crisis that surrounds aging Stalinist technologies will doubtless create renewed pressures to resurrect the brutal social controls that spawned such systems in the first place. People may feel it necessary to support authoritarian rulers who manage to



dom and self-government—telephones that work, widely accessible printing presses and copiers, and production machinery for small enterprises—farms, industries, and offices. But this will be possible only with extensive resources for investment and redevelopment, resources that the fledgling republics do not now possess.

What they will have in profusion for years to come are countless emergencies that will arise as long as the infrastructures of the old order remains in place. Such crises are evident in the nuclear-weapons and nuclear-power facilities that dot the former Soviet landscape. With their professional staffs in disarray

keep the lights burning.

As such pressures arise, it will do little good for Westerners to prattle on about the bracing virtues of the market. For the challenge at hand is a far more difficult one. What we are witnessing is an agonizing attempt to root out one culture of technology and replace it with another. It contains a lesson that our own ways of innovating too often disregard—the lasting dangers of treating human beings as mere ciphers. ■

*LANGDON WINNER is a visiting research scholar at the Center for Technology and Culture, Oslo. His most recent book is *The Whale and the Reactor*.*

Reviews

BOOKS

WHEN FEDERAL PROJECTS FAIL

The Technology Pork Barrel

by Linda R. Cohen and Roger G. Noll,
with Jeffrey S. Banks, Susan A. Edelman,
and William M. Pegram
Brookings Institution, \$36.95/\$16.95

BY ALEX ROLAND

THIS important book deserves a better title. The pork barrel is surely a provocative and colorful Americanism, and it is central to the story told here: that of the unimpressive record of "federal projects to develop new commercial technology for the private sector." The authors have even added some new wrinkles, such as an econometric scale from "low pork" to "high pork" and a hypothesis for congressional voting behavior that "pork in hand counts, but prospective pork is heavily discounted."

In other ways, however, the term ill serves the book. It lends a sensationalistic, muckraking tone to a serious piece of scholarship. It suggests that pork barrel politics is the main determinant of federal R&D funding, when in fact logrolling (where legislators vote for each other's pet projects), the political urgency of the research, and other phenomena play equally significant roles. And the term has now become hackneyed, whereas the material in this stimulating volume is original and significant.

The Technology Pork Barrel is built around six case studies: the American supersonic transport (SST), the space shuttle, the Clinch River breeder reactor, the Photovoltaics Commercialization Program, NASA's Applications Technology Satellite (ATS) Program, and the various programs to extract synthetic fuels from coal. The first four projects



the authors consider "almost unqualified failures." The ATS program, which attempted from 1963 to 1973 to pioneer new technologies for satellite communications, receives a passing grade because it achieved some early successes with commercial satellites before petering out. The authors see synfuels research as a partial success for its development of the combined-cycle coal-gasification project, which can use western (but not eastern) coal to produce a gas that is economically competitive with coal but cleaner burning.

As the economist authors show, the unsuccessful programs came to grief each in its own way. The SST fizzled because predictions about its technical feasibility proved overoptimistic. The shuttle has proved a failure because distributive politics—the pork barrel—blunted congressional scrutiny of its performance after the politically significant first flight in 1981. The Clinch River reactor followed a similar route but, unlike the shuttle, met its demise; initiated in 1969 near Oak Ridge, Tenn., as a demonstration project to convert spent fuel from conventional nuclear plants into both power and new nuclear fuel, the breeder fell victim to the declining demand for nuclear power.

Meanwhile, although federal R&D

on solar cells made dramatic progress in the 1970s, reducing costs by 90 percent, the photovoltaics program was cut back by the Reagan administration beginning in 1981 because it could not yet compete in the marketplace with other sources of electricity.

Even the relatively successful programs are presented essentially as failures. The ATS was canceled because NASA was more interested in supporting manned space flight and Congress found little political appeal in a program that promised mostly long-term development. And the synfuels program consisted of enterprises too numerous and scattered to build a political coalition based on pork barreling or logrolling, and could not survive the letup of the energy crisis in the late 1970s and early 1980s.

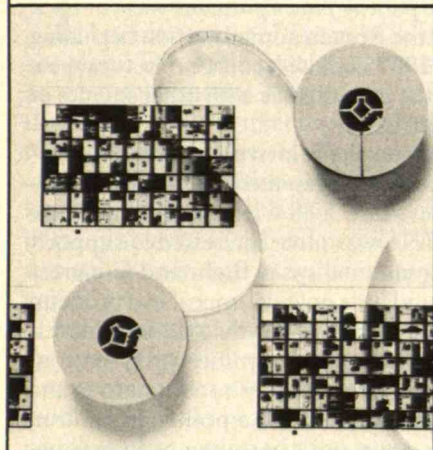
From Boon to Boondoggle

Despite the great differences in these histories, the authors manage to tease some generalizations from them. All six projects were reasonable proposals at the outset—promising undertakings for which the private sector was unlikely to have the resources or the motivation to conduct the fundamental research. Though often oversold by their sponsoring agency, the projects generally were not challenged on that basis. Indeed, the authors suggest that hyperbole is necessary to start up such programs, for it is only when the projects achieve "political salience" that real congressional support is likely to develop.

R&D projects of the kind examined here achieve that salience in two ways. First, external events may drive the technology into public view, as was the case with the synfuels project during the energy crisis of the 1970s. Or, like the space shuttle, they may distribute enough jobs and contracts to enough congressional districts to build a constituency impervious to changes in fortune.

When either kind of congressional support is won, the technical merits of the undertaking drop to second place.

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REVIEWS

"Once the pork barrel phase begins," say the authors, "technical news will have to be very bad indeed to overcome the political inertia that prolongs a program." Economic justification of the supersonic transport, for example, disappeared between 1967 and 1969, but the program survived until 1971. The case for the breeder reactor collapsed between 1975 and 1977, but it had just won massive congressional support; distributive politics, especially in the House, sustained the program until 1983. Worst of all, the economic rationale for the space shuttle was gone by 1979, if not before, but the program has yet to be shut down. Indeed, it has found new life—not as the economical launch vehicle that Congress invested in but as an expensive service vehicle for the space station, another project that warrants the attention of these authors. Some of the projects limped along on the argument that they had already consumed vast amounts of money. But, as the authors stress, sunk costs are already lost and are no rationale for continued spending.

Toward Rational R&D Funding

The authors trace the government's poor record on commercial R&D projects to a failure to correlate political support with technical merit. Congress will provide long-term support for political, not technical, reasons. Conversely, it will withdraw support from technologically promising projects that have lost their political salience, as happened to coal gasification and photovoltaics. Meanwhile, agencies will sometimes advance projects while in the grips of a technological enthusiasm that moves them to keep Congress in the dark about alternative development paths.

The authors' solution is to establish government agencies and congressional committees specifically to oversee selection and funding of R&D projects with commercial potential. The goal is to remove decisions about continuing R&D from the hands of agencies and

committees that have a vested interest in seeing a technology become operational. Thus agencies would not be tempted to force projects like the space shuttle into unwarranted operation, and Congress would not be tempted to support projects like the breeder for reasons of distributive politics. Decisions would presumably be based on technical merits.

The authors have little illusion, however, that Congress or the executive branch will voluntarily divide their responsibilities this way. Pork, like other forms of political spoils, exists to serve not the polity but the officeholders. So *The Technology Pork Barrel* stands as a warning that we can expect more projects like the SST and the breeder reactor.

But this is a counsel of despair. What the case studies really imply is the need for a national industrial policy. Ever vigilant in their resistance to socialism, Americans are wont to keep business and government an arm's length apart. Into the gap flow overzealous and often misguided bureaucrats and politicians who define the national interest in terms of their own job security. Often these natural adversaries make common cause: the bureaucrats distribute grants and contracts to curry congressional and administration support, and politicians turn commercial R&D into a pork barrel.

It is time for this important issue to come out in the open, where the national interest can be publicly debated and R&D policies can be clearly articulated. Safeguards can be built in to prevent a return of the robber barons, though not to prevent all inequities. But *The Technology Pork Barrel* is testimony that the dangers we fear are no worse than the mistakes we have already inflicted on ourselves. As long as the countries with which we compete, such as Germany and Japan, have national industrial policies, we must follow suit or risk falling ever farther behind. ■

ALEX ROLAND, a former NASA historian, is a professor of history at Duke University, specializing in military and technology history.



BOOKS

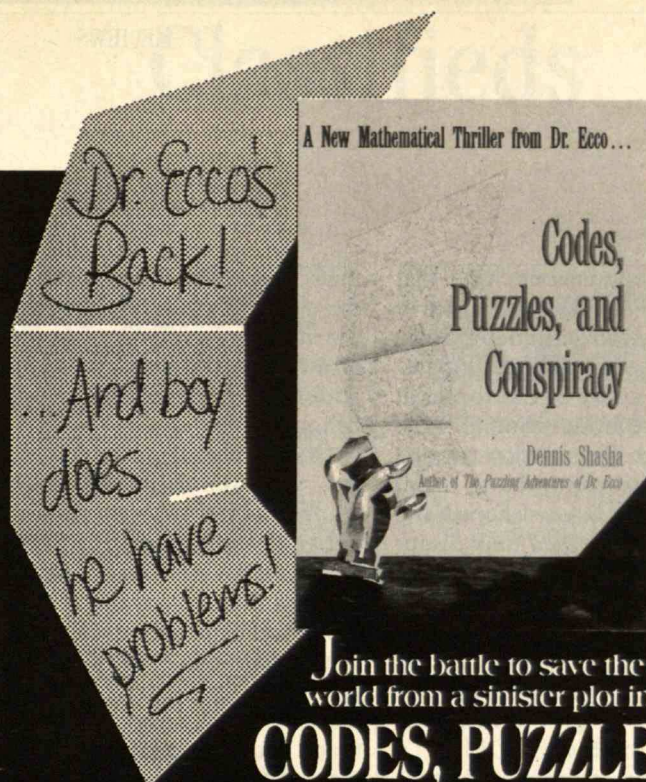
INVESTIGATING THE CITYSCAPE

*The City Shaped: Urban Patterns
and Meanings Through History*
by Spiro Kostof
Bulfinch Press/Little Brown, \$50

BY THOMAS FRICK

To think about cities is to think about everything human. So to understand why they formed the way they did, one must consider every activity under the sun—religious, military, administrative, legal, commercial, and artistic, as well as the countless vagaries of private life. No wonder treatises on city form tend toward either visionary idealism or erudite specialization, and greatly oversimplify the many complex and interlocking forces at work.

Pierre Lavedan, in his 1959 *Histoire de l'urbanisme*, coined two euphonious but misleading terms—*la ville créée* (the created city) and *la ville*



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spontanée (the spontaneous city)—that codified the way people have tended to contemplate city development. Spiro Kostof, a professor of architectural history at the University of California at Berkeley aims to undermine all such tidy dichotomies. Because Kostof revels in minute architectural and social details, disavowing larger schemes and systems, *The City Shaped* may disappoint those who prefer straight, narrative history. But adventuresome readers will find Kostof's book an entertaining and beautiful, if somewhat haphazard, tour through the vast profusion of city designs, forms, functions, and developments.

What we see in looking at a city is often what we want to see. A city's plan, for instance, may show an inflexible and uniform grid, whereas the actual place-

ment, shape, and height of the buildings can create an effect of picturesque irregularity more evocative of unplanned growth. Whether such a scene is *créée* or *spontanée* is largely in the eye of the beholder.

On the other hand, an initial appearance of randomness can be highly misleading as well. Kostof reports on an urban design seminar he attended in Siena, at which prevailing doctrine decreed that this medieval city's form developed impressionistically as the natural topography of the site was gradually filled in. When he looked into Siena's history, however, Kostof found that it was "one of the most highly regimented designs of medieval urbanism," extending even to the shape of the windows and the enforced use of brick. The deceptive aspect was simply that instead of opting, like Florence, for the proto-Renaissance visual clarity of the wide, straight line—easily recognizable as a sign of conscious city planning—Siena legislated various embellishments and reinforcements of its many smoothly truncated curves.

"Form, in itself, is very lamely informative of intention," Kostof writes. "We 'read' form correctly only to the extent that we are familiar with the precise cultural conditions that generated it." We can't understand Siena, the author implies, until we understand the ways in which an older aesthetic, the preference for "unorganized" form, persisted alongside newer formulations like that of fifteenth-century architect Leon Battista Alberti, who proclaimed: "The principal ornament of a city is the orderly arrangement of streets, squares, and buildings according to their dignity and their function."

The Minutiae of History

The trouble is, such important cultural considerations are great in number and rife with ambiguity. The ubiquitous urban grid, for example, so rational and seemingly easy to read, abounds in possible deceptions. Its flexibility can accommodate democratic or authoritar-

ian groupings; it can disguise itself by climbing hills or bending to river courses; the farming village and the megalopolis both fall within its net; and it can nourish communitarian stability or speculative greed. A city's formal elements, divorced from its particular history, imply nothing, the author reiterates, and his ambitious attempt to illustrate this theme leads him to jump somewhat dizzily around the globe and back and forth in time, charting exceptions to every rule while piling up the minutiae of history.

But it is those minutiae that enable Kostof to convey the city as a form of life rather than as an abstract map. Some examples:

Our word "colony" derives from the Latin *colere*, to farm, and early Italian colonies were towns built quickly for settling Roman war veterans in areas where they could keep watch over conquered territories. Through the novel square grid, the Romans imposed their New World Order on the more primitive outlying landscape and villagescape.

In Islamic cities the minimum width for public streets is based on a saying by the Prophet: seven cubits allows two fully laden camels to pass each other. And the Moslem concern with privacy determined such things as window and door placement, screening, and the lack of visual corridors, even in the streets. Since interior life, centering on the courtyard, was most important, little attention was paid to the appearance of the side of the house that faced the street.

The boulevard began life as a walkway atop the defensive ramparts on the boundary between city and country. The practice of planting the walkway with trees was a strategic device to camouflage the precise edge of the town from approaching enemies. The roots of these trees strengthened the artificial embankments. But during peacetime, citizens used boulevards for shaded promenades with pleasant elevated views of the countryside.

In a fascinating chapter on "The City

TechnologyReview

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as Diagram," Kostof looks at idealized urban forms such as the astonishing nine-sided Palmanova, a military outpost south of Venice; the utopian Sforzinda, a never-built Renaissance city designed after astrological and magical symbols; Saltaire, a socially progressive workers' city in Yorkshire, England, commissioned by a captain of industry; the spiral ashram city of Auroville, in India, devoted to religious meditation; and Arcosanti, the dream of Paolo Soleri rising slowly in the Arizona desert, which he hopes will breed new human relationships as "function follows form."

These single-purpose cities are not close to Kostof's heart. When they do get built, they are often "overtaken by reality, the way we really are and behave when we are not under rigid surveillance." Palmanova, for one, has survived in its original form, though "not as a viable community but as an unwitting exhibit in a museum of ideal cities."

Kostof's bias against idealized city formation does lead him to slight some important urban planning principles derived from religious beliefs. Cathedrals are barely mentioned. And he only touches on Chinese geomancy, a pervasive philosophical system governing landscape interpretation and the placement and form of buildings. He neglects entirely the founding of cities on sacred sites and their siting through various forms of divination—both common ancient practices that influenced city development.

However, this lapse is forgivable in a book otherwise so rich in detail. Though we're not rewarded with a single satisfying thesis, we're made more sensitive to the dangers of oversimplification. *Jede Stadt hat ihre eigene Geschichte*, goes an old German motto: Every city has its own history. That could be Kostof's motto as well. ■

THOMAS FRICK, a free-lance writer who lives in Los Angeles, contributes to Art in America and other magazines.

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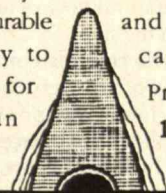
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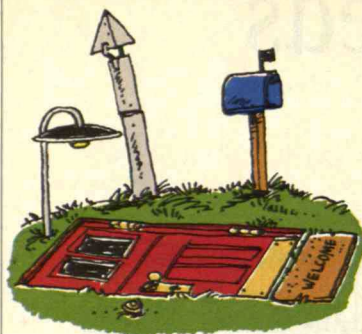
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Notes



Going Underground

While many people might acknowledge the environmental advantages of an underground city, few would want to live in one—unless, perhaps, it were built into the side of a mountain. That's the conclusion reached by Gideon Golany, professor of urban design at Pennsylvania State University, who points out that "building an underground city into a hillside would allow many buildings to be flooded with sunshine and to be ventilated by the natural flow of air up and down the slope."

Gideon, who recently completed a study of underground buildings in Japan, proposes that his so-called "geo-space" cities could be built in three tiers into hills with slopes as steep as 80 degrees. The first tier, comprising homes, offices, schools, stores, and hospitals, would be built 10 meters deep into the slope and be fused with an above-ground city. The second, for roads, parking, subways, sewers, power stations, communication systems, and nonpolluting industries, would be built between 10 and 50 meters down. And the third, lower still, would be allocated to such long-term functions as automated warehousing. Such a structure would not only conserve land, he says, but it would reduce the infrastructural costs of a city by 75 percent.

Light Therapy

A new treatment under development can kill cancer cells with ordinary white light. In preliminary work on mice, researchers at the University of Illinois at Urbana-Champaign

injected subcutaneous tumors with a special compound that helped destroy the cancer cells when the rodents were placed in incubators resembling miniature tanning salons.

This compound, which consists of a common amino acid and a synthetic enzyme, stimulates the cancer cells to produce a light-sensitive substance called protoporphyrin, which is normally produced in trace amounts in all living cells. In fact, in plants, this substance functions as a chemical precursor to chlorophyll. Research in plant physiology conducted by one scientist on the team suggested a cancer-killing mechanism for animals: if enough protoporphyrin accumulated, light would trigger the release of an oxidizing agent that would disrupt and eventually destroy animal cancer cells. In one mouse placed in an incubator and exposed to the bright light of a slide projector for 45 minutes, a 1.5-centimeter tumor completely disappeared within two days of therapy.

Golden Age Users

The younger generation may claim the largest number of computer users, but they've got nothing on older adults in terms of enthusiasm for their machines. A two-year study of 36 women aged 55 to 95 who were given computers to use in



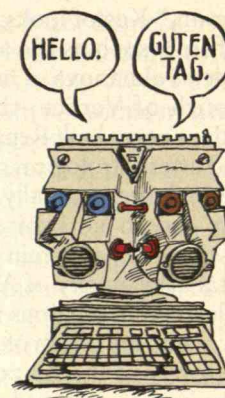
their homes showed that they embraced the technology to enrich their lives and increase interaction with peers.

Through a simple electronic mail system, the women became adept at receiving news and weather reports and communicating with each other. For example, they arranged luncheon meetings for the group and compiled recipes for a cookbook. Far from being intimidated by computer technology, the women enjoyed the mental challenge, says principal investigator Sara Czaja of the University of Miami, and wanted additional features, such as on-line banking and shopping and electronic access to health services and educational materials.

A Cure for Babel

Imagine speaking into a box and hearing what you say translated perfectly into another language. Just such a system, "fluent" in English, German, and Japanese, has been demonstrated recently by researchers at Carnegie-Mellon's Center for Machine Translation. Named Janus, after the Roman god with two faces, the computer workstation-based speech-recognition system parses each sentence, breaking it down to its constituent parts to extract its meaning. The system then translates each word, reconstructs each sentence into the second language, and, using speech-synthesis software, delivers the results out loud.

Besides being the first to build a complete, speaker-independent system with a vocabulary as large as 400 words—Janus's current capacity—the researchers say they have incorporated a neural network that learns parsing simply by studying examples of various sentence structures of each language. This has proven far



more efficient, they say, than trying to program the system with extensive grammar rules enumerating all possible sentence constructions.

Bug-Proof Potatoes

One of the first genetically engineered food crops to end up on our dinner tables may be none other than the common potato. Researchers at the University of Wisconsin have been able to incorporate a natural biological pesticide into several varieties of Russet Burbank baking potatoes.

The transformed potatoes contain a gene of the common soil bacterium Bt, which produces a protein that is harmless to humans but lethal to the plant's worst insect predator, the Colorado potato beetle. And because most of the protein insecticide is produced in the potato plant's leaves rather than in the carbohydrate-rich tuber, the altered potatoes were apparently identical to the original varieties in size, weight, taste, and yield.

Farmers have applied Bt sprays—generally recognized as among the safest of insecticides—for nearly 30 years. But the genetic approach is more practical, according to the researchers, because sprays wash off, are deactivated in a few hours, and must be timed precisely to a brief period in the beetle's life cycle.

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